

# DELHI UNIVERSITY LIBRARY

Cl. No. N156:N10x9

45

Ac. No. 51992

Date of release for loan

This book should be returned on or before the date last stamped below. An overdue charge of one shma will be levied for each day the book is kept beyond that date.

---

# **BUILDING AND SOCIETY**

---

A Series of publications  
on the  
Engineering, Constructional and Financial  
aspects of  
Town and Country Planning, Housing, and the Promotion of  
Public Health  
prepared for the  
Co-operative Permanent Building Society  
and Edited by  
EDWIN C. FAIRCHILD, Phil.D., M.A.

***Municipal and Private Enterprise Housing.*** R. L. REISS.

***What Housing Costs.*** WALTER HILL.

***The Building Industry: Its Work and Organisation.***  
F. LESLIE WALLIS.  
(President: Building Industries National Council).

***Financial Freedom for Housing.*** R. McNAIR WILSON.

***Planning and Transport: Their Effects on  
Industry and Residence.*** WALTER SEGAL.

***Who Shall Rebuild Britain?***  
L. H. KEAY, O.B.E., M.Arch., F.R.I.B.A.

***Water, Drainage and the Community.***  
ROLT HAMMOND, A.M.I.C.E.

***Building Societies: Their Reform and their Future.***  
EDWIN C. FAIRCHILD.

---

## ANNOUNCEMENT

Not many months had passed after the outbreak of War, in September, 1939, when the problems of planning and housing moved forward to a prominent place in public estimation. The complexities of physical reconstruction were not then clearly apprehended. Nor was it realised how far the re-casting of town and countryside would have to extend if the distribution of industry, the utmost economy and convenience in transport, a desirable distribution of houses, and an agricultural system held in proper balance with the nation's general needs were all, concurrently, to be dealt with in an orderly and constructive manner.

The years went by and tangled confusions which frustrate every effort towards the re-making of Britain became more evident. Some, now inclined to abandon the task in despair, would be satisfied with any meagre modification of pre-war conditions; others are strengthened by the difficulties which confront them. In accordance with the natural law that Challenge invokes Response they would strike down to what they conceive to be the root causes of the vested rights and powers which retard the pace of social change.

In this intellectual and material turmoil what was written twelve months ago is already out of date. Events, like the social mind, move so rapidly that the land question, the distribution of the people, where they shall live and how and where they shall work, are matters on which there is something fresh to be said at intervals not more lengthy than a few months. The eight short books to constitute this series and published under the general title, *Building and Society*, will be written by authors, each an expert in his field. In every case the author will alone be responsible for the opinions his pages present; for their singularity, their steadfast or progressive character, their orthodoxies or heresies, the Directors of the Co-operative Permanent Building Society have no responsibility whatever.

As a controlling Board of a far-extending organisation concerned with planning, building and problems of finance, the Directors of the Co-operative Permanent Building Society are in daily contact with the issues which this series of publications is to canvass. Before those issues can be simplified and solved they must be understood. Their free discussion is an imperative need of our time. In that conviction the Directors of the Co-operative Permanent Building Society authorise these publications. They intend that the eight publications here announced shall provide a free platform subject only to restraints imposed by the proprieties and rules of public debate. With that plan for toleration, it will be found, the writers readily conform.

**BUILDING AND SOCIETY**

---

**PLANNING AND TRANSPORT:  
THEIR EFFECTS ON INDUSTRY  
AND RESIDENCE**

by

**WALTER SEGAL**

**J. M. DENT & SONS, LTD.**

**London and Letchworth, Herts**

**(for the CO-OPERATIVE PERMANENT BUILDING SOCIETY)**

**1945**

WALTER SEGAL

*Architect. Known as a contributor  
to Architectural and Building  
Trades Journals*

Printed and made in Great Britain by the  
Dorling Press, Ltd., Wellingborough.

## PREFACE

BY THE EDITOR

The purpose of the Town and Country Planning Act, 1944, is to endow local authorities with a capacity for reconstructing areas that were subject to extensive war damage. In dealing with that considerable task they will be able, in a degree more or less substantial, to give some attention to the important principles which Mr. Walter Segal adduces in respect of the re-location of industry, the siting of houses, and the provision of open spaces between one built-up district and another. It would be rash to contend, however, that that highly controversial measure will carry the Central Departments of the State or its local administrative organs any long distance towards solution of the problems for which the older legislation affecting town and country planning, housing and transport was, and often still is, too readily supposed to be adequate.

Under the sixty-six sections of this latest Town and Country Planning Act it may prove that the price of land, for any public or private purpose whatsoever, will be further increased beyond the rapidly inflated values its proprietors have been able to obtain in recent years: it may be found that the Act offers industrialists inadequate encouragements to transfer their works to new towns, or to long-standing towns of smaller size, and that this deficiency cannot be repaired by a Minister's persuasion. Further, it may be forcibly restated, almost so soon as the Act gets under weigh—that no large-scale redistribution of housing can be encompassed without a collateral revolution in the roads plan and the methods of transport; and last, it is almost certain to be discovered that the Act offers but the scantiest opportunity for extending the area of open spaces and playing fields accessible to residents in large towns, a need which Mr. Segal rightly desiderates as imperative for the community's general health and pleasure. Nevertheless, the new townships and housing estates should be more pleasing than the squalid suburbs of the later nineteenth century, or the meretricious building which composed so large a part of housing efforts between

the two great Wars. Meanwhile, the ideas embodied in this small book should offer many avenues for necessary propaganda.

Early in these war years it was widely held that one result of the conflict would be a large extension of communal living when peace returned. Cooking, necessary washing in the laundry, sport, our gardens, meals, our pleasures would all, it was asserted, be taken or enjoyed in common with genial neighbours. Comradeship in the ranks, the rough heartiness of the camp, like that somewhat rootless sing-song atmosphere in munitions factories would, it was certainly anticipated, find their after-war expression in a frictionless uniformity when the piping times of peace once more became the vogue.

There will be large instalments of uniformity; that is no longer in doubt. Temporary houses and, perhaps, houses not so temporary, utility productions, more branded foods and patent medicines, coupled with restrictions we cannot annul till several years are gone—these arrangements will ensure uniformity enough. But the similarity will not be frictionless. Far from wishing to live so closely with neighbours there is an emphatic revival of the demand that for those who want a separate house and garden a house and a garden should be provided.

On the other hand discussion of the plans for London, Plymouth, Birmingham, reveals that a large number of persons prefer to live in flats or tenements, on the understanding that easy access to upper floors is available and that when winter rages there is adequate storage for coal and its transport to rooms at high altitude. Not many of the unmarried, widows, widowers, or aged persons, whether poor or well-to-do, want a house of their own.

Carrying this analysis farther there are some who like noise; others long for a quietude almost unknown in towns with their myriad wireless and foreign to a countryside which aeroplanes invade. The former, wanting to see and hear roaring traffic go by, would not welcome the through-access roads and peaceful precincts which Mr. Segal and Mr. Alker Tripp offer for their comfort and safety. A pedestrian's risk on a main arterial road is a mere butterfly's risk for them; instead of comfort they love commotion. These turbulent souls compose a large part of the population and towns and houses have to be made for their occupation, as for other men and women in every way antithetical in tastes and demand.

Another of Mr. Segal's leading ideas may suffer laggard treatment in adoption. In the last fifty years how many acres have been added to open spaces in the towns of Britain with more than 100,000

residents? A few parks which formerly were private, like the Clissold and Springfield Parks in London, have their counterpart in large provincial centres. Progress in that direction has been meagre. Still more restricted is the relative extension of playing fields per head of the children and young persons in densely populated urban areas. True, where the formerly unbuilt upon land is to be covered by new roads or buildings the Act, of 1944, authorises the acquisition of land for the replacement (elsewhere) of an open space in a war damaged area. Farther than that the Act does not travel beyond the power to provide open spaces derived by local authorities from the statutes which control Public Health and Housing and which have been law for several decades past.

Moreover, there are dangerous sections embodied in the Act. By sanctions for the Orders they require they allow the Minister to permit building on commons and open lands which the public have been free to roam upon in some cases for generations. With the arbitrary powers to appropriate common lands by new enclosures still starkly fresh in our memory, which the Requisitioned Land and War Works Bill, in its original form, proposed to confer on the Treasury, the Defence Departments and the Postmaster General, it would seem that some especially drastic effort may be required before green wedges to the heart of towns, and green belts around them, can become more tangible than things only wished for ardently. Cost of land has crippled the movement for open spaces.

Nor would the Uthwatt Committee's recommendations have been of copious avail in this connection. More comprehensive action would seem to be required than is implied by the proposal to acquire development rights. In the turmoil of argument and political strife by which the return of peace will be marked it may be urged that, under a system of national land ownership, the rents of sites especially profitable for their occupants would suffice for more than redemption of the cost of purchasing the soil. In the troubled times immediately ahead, it may, perhaps, be contended that the revenues from land would also yield a margin so broad that the nation, then in possession of a means for the rapid expansion of its open pleasure grounds, would no longer find its aspirations for public improvements thwarted by a fear that the expense incurred by their provision could not be justified. Had we courage and scientific imagination enough to deal with such matters now, by all the evidence, our future would be easier than probability presents.



# CONTENTS

	PAGE
PREFACE ... ..	5
CHAPTER I—ZONING ... ..	9
1. Fabric of Urban Structure   2. Historical and Socrological Facts.	
3. Principles of Zoning,   4. Residential Areas in Relation to Business	
and Industrial Areas—Buffer Zones.   5. Zoning and Transport.	
CHAPTER II—ROAD PLANNING AND TRAFFIC . . . .	35
1. Network of Communications.   2 Classification of Roads.	
3. Mechanised Transport with Separate Networks of Communications.	
CHAPTER III—LAND SUBDIVISION . . . . .	53
1. General Principles.   2. Subdivision of Building Blocks.   3. Cost	
of Development   4. Existing Urban Areas.	
CHAPTER IV—OPEN SPACES ... ..	77
1. Densities of Population and open areas.   2. Siting and Lay-out.	
3. Traffic and Open Spaces.	
CHAPTER V—RESIDENTIAL UNITS ... ..	86
1. Medium Size Town as Unit.   2. Residential Sub-Unit.	
INDEX ... ..	90

## ILLUSTRATIONS

	PAGE
FIGURE 1—City and Industrial Islands grow at the expense of Residential Districts	16
FIGURE 2—Tendencies of Expansion in the Modern Town	17
FIGURE 3—Tendencies of Traffic between Residential Areas, City and Industrial Areas	18
FIGURE 4—Concentration of Industry and Complete Separation from Residential Areas	22
FIGURE 5—Dislocation and Decentralisation of Industry in connection with Garden Cities	23
FIGURE 6—Re-location of Industry in New Area Outside the Town, Peripheral Location of Business linked with Industry	24
FIGURE 7—Re-location of Industry in New Area separated by Green Zone from the Town	25
FIGURE 8—Relation of Form and Depth of Plots, to Land and Development Costs	70
FIGURE 9—Comparison of Percentages for Lay-outs of Equal Acreage	73

## CHAPTER I

### ZONING

#### I. FABRIC OF URBAN STRUCTURE

THE complex nature of modern urban life is reflected in the variety of forms and types of urban settlements which, in an important sense, may be regarded as the backbone of our civilisation. Today, as in the great times of Ancient Greece and Rome, civilisation is essentially the creation of the *civitas*, the community of town dwellers.

Since the industrial era the progress of urbanisation has been steady. The tremendous increase of population in many European countries during the last century is closely connected with the development of towns. In that period the relations of town and country were subjected to continuous change with the result that, the hegemony of the towns having been established, in the industrial countries of Europe at the close of the 19th century the number of town dwellers exceeded not inconsiderably the number of the rural populations. At the beginning of this century nearly three-quarters of the inhabitants of Britain were living in large and small settlements which with more or less justification claimed for themselves the status of towns.

These urban areas vary greatly in regard to type, size, structure, purpose, means of existence and national importance; other factors such as age and traditions require consideration, especially in cases where the 19th century has not accelerated a natural development. If we approach the problem of classification of such areas in accordance with the occupations and activities of their inhabitants—and this is a practical method in the case of modern towns—we may distinguish between four principal groups and a number of composites. There are, first, the centres of production of raw materials, and these exercise a distinct influence on the urban areas which develop in their proximity. Next, there are the centres of manufacture. In a third group are the centres of commerce and distribution. And fourth are the centres of organisation, representation and consumption. All these groups tend to develop more

or less in association so that in many instances, especially in the case of larger towns, industry and business as well as representation and consumption form and determine the character of the town.

In particular, business has always shown a tendency to follow industry and, similarly, the functions of representation and consumption are often allied. On the other hand smaller towns usually evince a natural tendency to specialise whereas, in the metropolis, we find an abundance of purpose and a variety of activities which seem to separate its problems entirely from those of other urban areas.

While the structure of towns is largely influenced by the activities and occupations of their inhabitants, their individuality is, of course, largely conditioned by locality and climate. The latter has played in the past an especially important part with regard to residential areas in relation to industry. The smoke of the chimneys of factories and the prevailing West-East direction of the winds in Europe have, for the last two centuries, favoured the development of residential districts in the western parts of the towns.

The largest portion of urban land is, of course, used for residence, and here the relative compactness of the built-over land must be considered. In most towns of large and medium size the quiltwork of residential areas differs greatly in its consistency and in the relation between the acreage of built-over land and the numbers of inhabitants. The Hague, for instance, a town of roughly 500,000 inhabitants and pre-eminently residential and representative in character, covers about the same area as Paris with its four million citizens. In the former case a tremendous sprawl, in the latter a very considerable concentration as would befit a former fortress.

In general the fabric of urban areas is largely determined by the varied requirements of occupation, residence, recreation, health and education. These functions have changed considerably in the course of time and are continuously subjected to new interpretations. Each consecutive urban generation planned its space in accordance with its own requirements and had to make the best of what it inherited from the past. And with each generation the relation between residence and occupation became increasingly problematic, starting with the separation of dwellings and places of work at the close of the Middle Ages and ending with the present state of affairs in large towns where, sometimes, more than ninety per cent of the inhabitants live and work at widely separated places.

In addition to the basic elements of the urban fabric above

mentioned, there are others which, though they may be termed auxiliary, are nevertheless integral and indispensable. Such other elements are administration, communications, services and supplies. They are, with the exception of administration, highly dependent on pre-eminently technical factors and they have in our time, with its vastly increased standards, become vital questions of almost menacing importance. The structure of modern towns and the conditions of modern life make efficient communications particularly desirable and indeed essential. Similarly the problem of services and supplies, with each generation, assumed greater importance and created frequent obstacles. With regard to the latter it is a notable fact that existing water mains, sewers, electric supplies and gas installations often strongly support the retention of an existing grid of roads and streets because of their heavy cost.

It is the space relation between the four principal urban requirements which determines the structure of a town and more particularly the relation between residence and occupation, between dwellings and places of work. The more or less problematic character of this relation depends considerably on the respective sizes and numbers of populations of and resident in the various urban settlements. It is often maintained that this is partly a matter of communications, and partly a question of concentration or decentralisation as the case may be. This is the more true the smaller the urban community to which it is applied.

Most of the urban problems of our time are problems which have arisen in the big town and which only partially affect the medium size urban community, not to mention the small township and borough. The latter may be a centre for the production of raw materials, or it may house a few manufacturing industries. It may be a market town and a centre of distribution. Or it may have a predominantly residential character. In all cases, however, there will be a comparatively simple pattern of layout partly based on tradition and the heritage of the past, partly consisting in new additions and adaptations in accordance with the changing requirements of each generation. The network of streets and lanes will suffice even for an increased traffic, or require only few amendments. The areas used for residence, occupation, etc., are relatively clearly defined. A satisfactory segregation of dwellings and industries is therefore possible without involving difficult problems of communication or causing inconvenience in travelling for the inhabitants.

Such places might, however, according to their situation, be compelled to cope with a certain amount of through traffic of more than regional character. While this might stimulate the growth and development of the town, it might eventually necessitate the provision of by-passes and the application of restrictions connected with them. Too lenient an attitude towards restrictions and their enforcement may result in the formation of a fresh nucleus in the vicinity of, or as near as possible to, the by-pass, which would suck the life out of the old town centre and frustrate any advantage which might have been obtained.

In the medium size town and especially the town that grew and developed quickly during the 19th century, structural defects are rather more frequent. Most of these may be associated with the speed of industrial development, during which control was largely lost. The towns which, owing to their location and adaptability, took part in the industrialisation of the country were quickly transformed. Central districts which had grown harmoniously and were clearly defined in their functions lost their importance and were soon dwarfed by new quarters which grew concentrically around them, in more or less haphazard fashion, without the guidance of any far-sighted policy.

Industrialism, with its tendency to concentrate large populations on small areas produced an intolerable shortage of dwellings, abominable housing conditions, overcrowding and excessive densities of population. New quarters of extending towns were laid out with little consideration for the needs of their inhabitants; many of them were slums from the beginning. In towns with increasing commercial importance, the central areas—once the most valued residential districts—lost more and more of their inhabitants to the outer areas of the towns. Business premises took the place of private houses. This decentralisation of the residential quarters in the inner town was greatly furthered by the centripetal tendencies of commerce.

Thus already in the medium size town the relation between the areas used for the various functions of urban life is often quite unsatisfactory. Residential quarters, business districts and industrial areas are sometimes coherent in themselves and there exists a certain degree of distinction between them. More often, however, split up and widely scattered over the entire urban area, they are comparable to islands of varying structure and size. It is in such

urban settlements that the centripetal tendencies of commerce and the centrifugal movement of industry may be studied best.

In the medium size town the formation of islands as described cannot be but undesirable for it complicates the problems of communication and renders transport wasteful. It seems however that this development of islands is closely related to the extension of urban areas and to the numbers of population because, in the bigger communities, the retention of large coherent areas of different structure and use becomes increasingly difficult. If for instance in a large town places of work could be concentrated in one continuous area and if a similar concentration of dwellings could be effected, the average distances between occupation areas and residential areas would be greatly increased. A considerable part of the transport system would then only be used for traffic between the two areas during rush hours.

As it is, the setting up of islands appears to occur at a certain stage in the development of a big modern town. That is one of the inevitable facts which the planner has to accept. It may be added that it is far less the existence of islands and the fact that large towns are mostly conglomerations of such islands which makes the large town so complex a tissue of problems; it is much rather that many of these communities have grown at a speed under which planning eventually had to break down.

## 2. HISTORICAL AND SOCIOLOGICAL FACTS

The large contemporary town is in most of its bulk the product of the past 150-200 years. Its foundations were laid by the industrial revolution and it grew like a cancer, destroying the structure of existing cities and deforming existing villages, or developing independently in the open country in the vicinity of industrial settlements. Existing big towns, like London and Paris, which took a prominent part in this race increased their populations immensely during the second half of the 19th century. In that short period London almost doubled its population of nearly three millions while the population of Paris rose from little more than half a million to almost three and a half million.

Before the industrial era which initiated this urban growth by leaps and bounds the development of towns had been far more gradual. When at last in the period between the 10th and the 14th centuries urban life in Europe rose again it began, as before in

antiquity, with the separation of agricultural and industrial production. New towns grew as settlements of craftsmen and the urban communities which had survived the storms of the migrations recovered.

The towns of that time depended structurally on the cohesion of individual dwellings and places of work—the artisan's house where the living quarters were planned above his workshop. The various trades settled corporatively in streets and quarters which bore their name. Relative centralisation of communal life was expressed by the orientation of streets towards the market centre, which also had cultural and social functions. A certain amount of agricultural work was still done by town dwellers, sometimes even within the fortifications dictated by the political insecurity of the time. The simple structure of the early medieval town is not dependent on any specific layout plan. It is the basis of the irregular earlier towns as well as of the more regular foundations of the later centuries.

The next stage in the development of the medieval town was the separation of industrial and commercial production, another great division of labour. Stock production and accumulation of stocks required a higher degree of co-operative centralisation. As an immediate outcome of this evolution, the cohesion between individual dwellings and places of work was disrupted. Manufacturing centres developed like islands in the town area and commercial buildings monopolised the neighbourhood of market centres. Cultural and representative centres of community life lost contact with the original focus of the town and became independent. A new form of inter-urban traffic appeared, the traffic between dwellings and places of work, destined to become with growing numerical concentration one of the greatest impediments of modern civic life. The organic simplicity of the old town was destroyed; the disintegration of its structure by islands had begun. The period is that of the 15th-17th centuries.

Several of the great metropolitan cities of antiquity reached this stage but could not develop beyond it. While in the last centuries of antiquity industrial production arrived almost at the doorstep of the machine age, it had also reached the limits of its capacity—under the economic and social conditions of that time—in scientific and technical application. The towns had grown in buildings and inhabitants. Some even had passed the million mark, but nowhere was an adequate system of inter-urban communications developed.

In the *Rome of the Emperors* with its average density of 160

persons per acre, its main streets of only 17 to 20 feet width, and its seven-storeyed buildings, the traffic was so congested that carriages were permitted to proceed only during the last hours of the day. Owing to great distances and inadequate communications the outskirts of the town could not be properly developed. Even worse was the fact that the extent of the town proved a serious obstacle for administration and defence.

The industrial revolution saved the urban civilisation of modern Europe from a similar fate. Machines appeared in the traffic. Mechanical transport overcame or eased many of the problems which had been created by a continuous disintegration of structure. But other and no less serious problems came in its wake.

To continue with the evolution of the European town. While the tendency of commerce to concentrate in the central areas of the towns became more and more pronounced there began a decentralisation of the inner residential districts. In towns like London this evolution started as early as the end of the 17th century. The exodus of inhabitants from the central districts may have been considerably furthered by the fact that at that time wood was increasingly replaced by coal as a fuel and that the smoke of chimneys poisoned the air in the densely built central districts. Documents of that period seem to suggest that this nuisance was resented, especially by the female part of the population and that wives urged their husbands to leave the inner city.

A migration to the western districts of London, where the nobility and gentry built modern houses on spacious squares then began. While residential development followed the lines of decentralisation, the deserted city, increasingly subjected to a process of commercial centralisation, gradually diminished as a residential area. At the close of the 19th century less than 40,000 persons lived in the City of London; in the thirties of this century their number had fallen below the 10,000 mark. During the second half of the 19th century the number of inhabitants who left the central districts of Paris was equal to one-sixth of the total population of the town about 1850.

In general it appears that the growth of commercial towns and the depopulation of their central districts are simultaneous events linked by organic laws. How extensive was the part which commerce eventually assumed in the life of highly industrialised nations may be illustrated by the fact that in England, in the first quarter of this century, more than 27 persons out of 100 working for a living were engaged in commercial and allied activities. The



16 PLANNING AND TRANSPORT: EFFECTS ON INDUSTRY AND RESIDENCE  
 reflection of this trend on the structure of towns was inevitable. The growth of commercial centres within the central areas was accelerated.

In the mid-18th century a second movement of decentralisation was initiated in London and other towns by the exodus of manufacturers. C. Morris describes in *A Collection of the Yearly Bills of Mortality*<sup>1</sup> the setting up of manufacturing islands in the open country, their founders partly taking with them their workers from

# CITY AND INDUSTRIAL ISLANDS GROW AT THE EXPENSE OF RESIDENTIAL DISTRICTS.

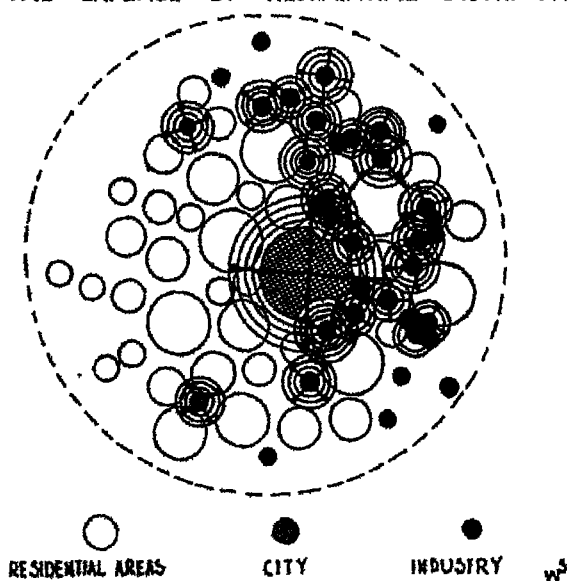


FIGURE 1

the town and partly relying on local labour. The decentralisation of industry during the 18th century in many cases resulted merely in the establishment of industrial outposts of urban areas which, later, were absorbed by the growing towns and thus shared the fate of villages in the neighbourhood of the expanding centre. Still later this decentralisation assumed the character of a centrifugal movement of industry to cheaper sites in the outskirts.

On the whole it can be said that the elements of the big modern town were stabilised already in the second half of the last century. The vast expansion of the great industrial and commercial centres

<sup>1</sup> P.R.C.I.T. IV. P. 923.

which followed shows clearly the trend of this evolution. The tendencies towards expansion were largely dictated by the centrifugal development of industrial islands in the outer districts of the towns, frequently in the East, North and partly in the South, and by the concentration of commerce in the central areas. Both city and industrial islands grow and extend at the expense of the residential districts in the inner town and in the eastern, north-eastern and south-eastern quarters. The suburbs extend and neighbouring villages are incorporated into the urban area (Fig. 1).

### TENDENCIES OF EXPANSION IN THE MODERN TOWN

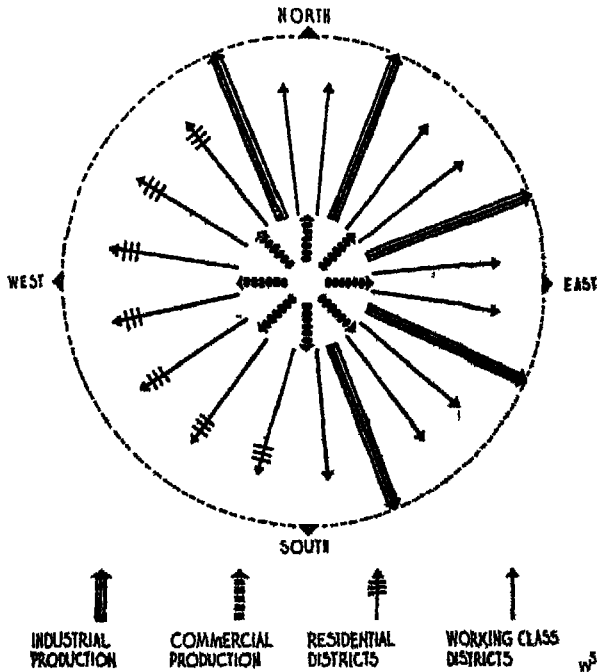


FIGURE 2

The expansion of the residential districts frequently takes place in two directions, partly towards the West, North-West and South, as a flight from the noise of the city and the smoke of industries in the opposite direction of the prevailing winds; partly towards the East, North-East and South-East where working-class districts develop in the vicinity of factories (Fig. 2). The centrifugal movement of industry and the expansion pressure of the city on the adjoining districts eventually produce decomposition of the existing urban

structure. The town is split into a multitude of islands of varying structure—industrial, residential, mixed residential and industrial, etc. The difficulties of communications between these islands and the enormously swollen traffic between dwellings and places of work in the city, or in the industrial areas, render most forms of mechanical transport wasteful. Already towards the end of the last century in London at that time almost one-third of a million passengers travelled every day from the outskirts to work in the city.

#### TENDENCIES OF TRAFFIC BETWEEN RESIDENTIAL AREAS, CITY AND INDUSTRIAL AREAS

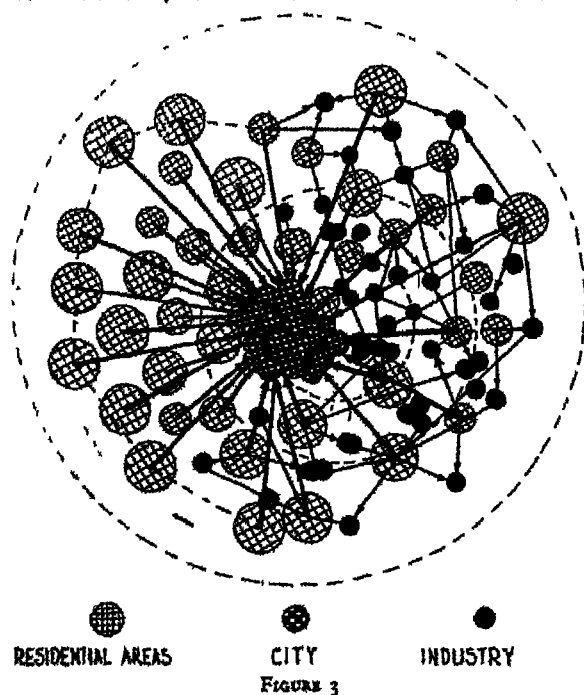


FIGURE 3

In accordance with this structural development traffic between outskirts and city tends to be radial, whereas traffic between residential and working-class districts and industrial islands cannot be defined as clearly. In its extremes it leads either through the entire inhabited area and involves long travelling hours or it shrinks to a short walk in the smoke of the factories. (Fig. 3.)

These in brief are some of the aspects of the development of the contemporary big town. In the last few decades the structural

difficulties of urban life have accumulated and the task become gigantic. Energetic attempts were made in this country after the last war to tackle at least one of these difficulties: the housing question. But while squalor may be abolished, hardship and inconvenience may remain. In other words the problems of housing and the creation of satisfactory relations between dwellings and places of work are inseparable.

These are two out of a large complex of problems which greatly affect the foundations of national life. They are, it must be admitted, mainly problems of the big towns but, then, modern civilisation is an urban system of habit and relationship and, naturally, the big towns take not only a more prominent lead in that form of civilisation than smaller communities, but also share all its disadvantages to a wider extent.

The task of providing satisfactory relations between dwellings and places of work in our time is essentially a question of location and transport. Location of housing, location of facilities for education, recreation and health, location of business and location of industry. The setting apart of suitable areas for these various purposes and their development depends in turn on suitable communications and the co-ordination of these two tasks eventually is an enterprise that can only succeed if it is undertaken on a nationwide scale. Only a national plan will also cope efficiently with the intricacies of land utilisation and ownership.

### 3. PRINCIPLES OF ZONING

All these various tasks in their application to regional planning may be comprised under the heading of "Zoning" which, more or less accurately, means control of urban development by defining the different uses of urban land and by making appropriate reservations accordingly; by determining the relation of built-over areas to open areas and densities of population, and by fixing heights, floor areas and spacing of buildings. It will be conceded that such controls in practice must necessarily be based on flexible rather than rigid principles and it is obvious that practice must vary with regard to size and type of town.

Small and medium size towns require an entirely different application of zoning principles than does the large city and, in their case, it is usually easier to formulate and to adhere to a general zoning policy. There is much less island development, more

coherence, while communications are simpler and shorter. No wonder that many town planners consider the small town to be a more satisfactory organism than the large city with its many structural defects. From a regional point of view there is much truth in this. Obviously, life can be planned on better lines for the individual citizen in the smaller town; work, residence and recreation are, even under the worst circumstances, tolerably well related to each other—or at least might be so. In the smaller town bad planning may well succeed in creating undesirable conditions but in the large town these are far more serious, because of the larger scale to which they apply.

From a national point of view, however, the big town, whatever its disadvantages, cannot be dismissed. In fact the large town is essential to a nation's greatness and importance. Among the great modern nations there is practically none that has attained its position without at least one or two big towns. Curse or no curse, it is the large town which attracts and collects an enormous part of the forces of the nation and assumes the leadership in political, economical, social and cultural affairs. There is as yet no sign that modern civilisation will be able to do without it. Extreme urban centralisations like London and Paris may be "great wens," but what were England and France without them?

A well-balanced variety of types of urban communities, large and small, is desirable and indeed essential to a healthy national life. If the big town has somewhat got out of control during the last hundred years, that is not an argument against its continuation. The task is rather to regain that lost control, to find appropriate solutions and compromises in dealing with existing facts and obstacles which the past has created.

Now it is obvious that the island structure of so many large cities renders the task of satisfactory zoning extremely difficult. Furthermore, in many cases, a system of communications is to be considered which has followed the haphazard growth of the town or has been adapted, with the passage of time, to suit new requirements. What can be done and given the necessary measure of control, what are the chances and possible extent of planning?

As an organism the large town is certainly more expensive to maintain and more wasteful of men and machines than the town of either medium or small size. It also seems that the big town frequently produces less and consumes more proportionately than the medium size town. Further, there is evidence that the cost of

producing goods in large centres is higher than in centres of medium size. This can be explained partly by pre-eminently economic facts such as standards of living, wages, rents and running cost; partly, however, it concerns defects of planning in connection with the location of industry, business and residence and means of transportation.

The term "decentralisation of industry" is now a household word, representing in connection with residential satellites and garden cities a trend of thought which is put forward with vigour and determination. The idea of self-supporting urban units at a suitable distance from, and in friendly relation with, an existing great centre has advantages, and whoever has seen it working cannot fail to be struck by the general soundness of the conception. There remains, however, the question to what extent this principle is applicable and how far it can be employed to relieve the existing problems of larger cities.

It may be asked, To what extent should the decentralisation of industry and its confinement to specified areas be encouraged? Is concentration of industry under all circumstances undesirable? Should industry always be separated from residential areas?

In practice the term "industry" comprises an enormous number of different activities and occupations, so different and even antagonistic in fact that a general location principle can hardly exist. While the centres of production of raw materials in many cases cover coherent areas and thus constitute concentrations (the same trend applies to heavy manufacturing industries), light industries often show a marked tendency towards decentralised location and, in towns, are frequently scattered over the entire urban area.

As many towns harbour great variety of different industries it will be obvious there cannot be two towns to which the same location principles can be applied. Moreover, while it appears imperative to separate by some means heavy industry with its noise and smoke—the latter in decreasing extent—from residential districts, light industries (food, clothing, etc.) constitute to a much smaller degree undesirable neighbours for dwelling houses.

Other factors to be considered in connection with the location of industry are size of town and means of transport. In many cases it may be found that the existing island structure might still be preferable to industrial concentration, or decentralised re-location, in new areas outside the town. The theoretical conception of a concentrated industry within the urban area, as shown by Fig 4.

### CONCENTRATION OF INDUSTRY AND COMPLETE SEPARATION FROM RESIDENTIAL AREAS

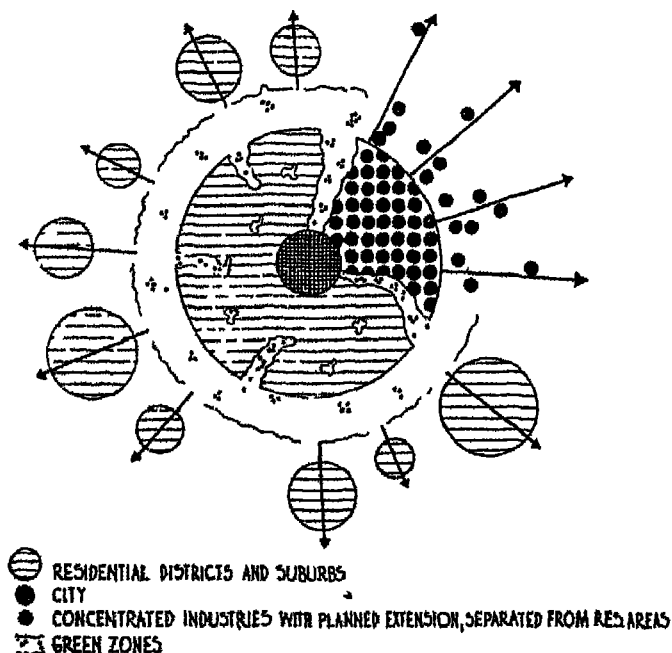


FIGURE 4

though it might in some instances improve upon an already existing tendency of development, could not be relied upon for general application and would aggravate already undesirable transport problems in bigger towns.

On the other hand it seems that industrial decentralisation by way of satellites and garden cities could be applied mainly to light industries which usually require no large concentrations and possess far greater mobility. There is, however, from the transport point of view the danger of too widely dispersed location, which seems rather to limit the applicability of the principle. The conclusion is, that the garden city is one of several other solutions to overcome the general problems of industrial location in relation to dwellings and that it can, with advantage, be used where light industries can be so grouped as to give occupation to the population of neighbouring residential areas in combination with full control over growth and development (Fig. 5).

The complete evacuation of industry and its re-location in new

areas outside existing towns would, in theory, achieve the ideal separation of industrial and residential districts and result in the constitution of two entirely different urban spheres—the dwelling town and the work town (Fig. 6). This separation might become still more outspoken if business could be shifted from the centre of the town to a more peripheric position linked with industry (Fig. 7). Such a type of town might be evolved from among existing industrial towns of medium size where the separation of urban structures could be preserved or should be achieved. In bigger towns, on the other hand, similar attempts would meet with unsurmountable difficulties. The inevitable extension of distances would be extremely undesirable.

As it is, planning principles that are perfectly suitable for the smaller and medium town cannot be readily transferred and applied to large centres and no theory of location can be devised which does

#### DISLOCATION AND DECENTRALISATION OF INDUSTRY IN CONNECTION WITH GARDEN CITIES

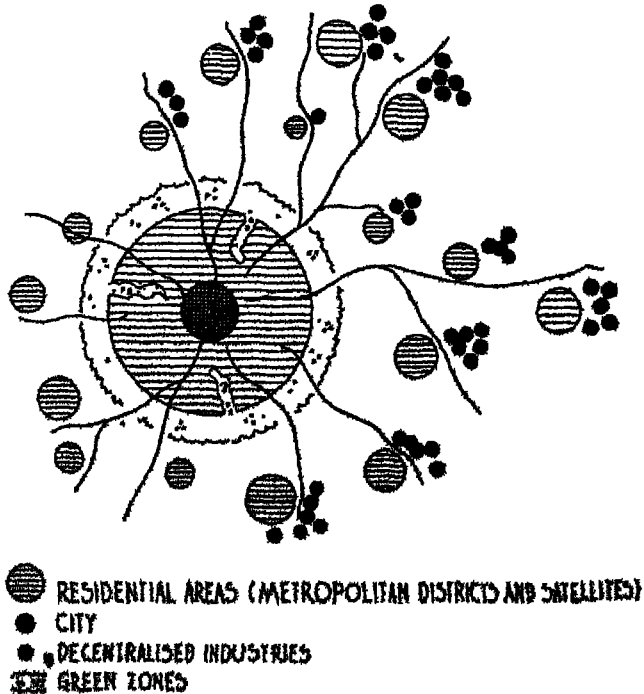


FIGURE 5



# RE-LOCATION OF INDUSTRY IN NEW AREA SEPARATED BY GREEN ZONE FROM THE TOWN

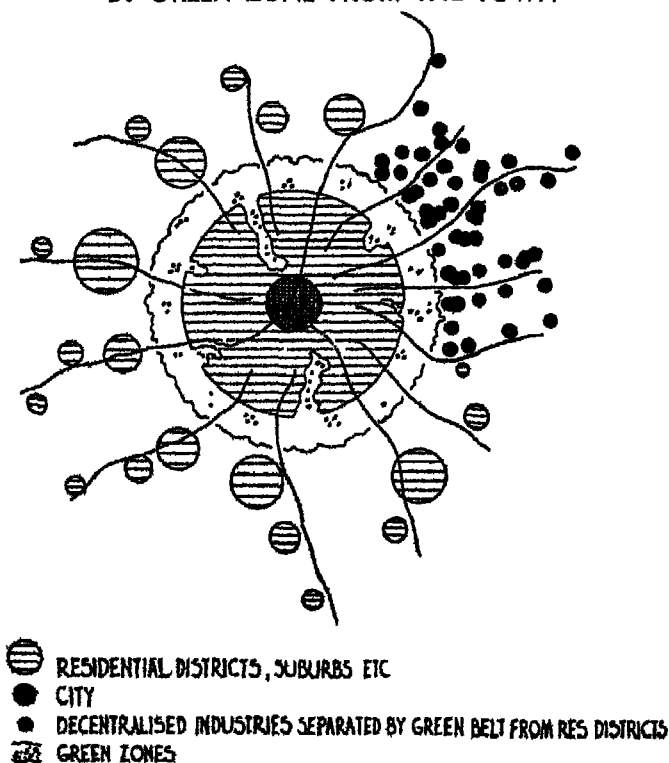


FIGURE 6

not require considerable modifications according to the type and size of town to which it is applied. The large city is a case in itself. That it should have been given a wide berth by many planners who approach the problems of modern urban life in the hope of finding an ideal solution is readily understandable.

An assessment of the advantages and drawbacks of the island structure of large modern towns may well prove that this form of structure need not necessarily be as bad as it is in many existing cases. It need not be inferior to other patterns where greater coherence of areas is achieved. The dispersion of inter-urban transport and the widely decentralised network of communications may, perhaps, be less uneconomical and involve shorter travelling hours than might be the case if industrial and residential districts were concentrated in two areas distinctly separated from each other.

Furthermore, the average distances between dwellings and places of work might still be shorter than in other systems where more intense structural separation and concentration would entail greater distances and longer approaches. This point is of special importance with regard to the extent of towns and the dislike which so many people feel for long journeys between their dwellings and places of work.

Take the case of the medium size town. Theoretically there could be one coherent industrial area and, similarly, business would be concentrated. Both would be well separated from the residential districts and yet there would be no great distances between dwellings and places of work. While the average distance between habitation

**RE-LOCATION OF INDUSTRY IN NEW AREA OUTSIDE THE TOWN, PERIPHERIC LOCATION OF BUSINESS LINKED WITH INDUSTRY.**

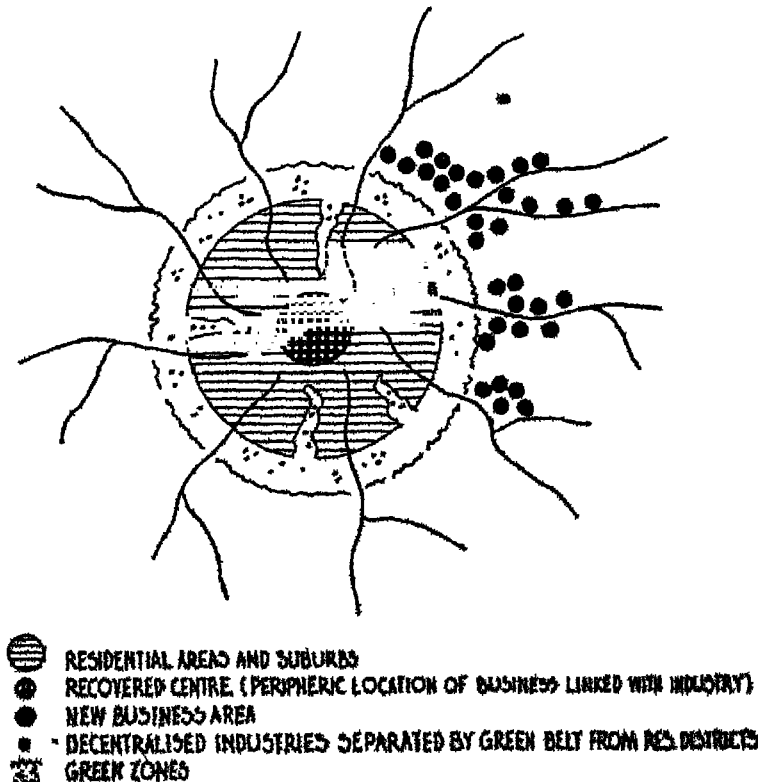


FIGURE 7

and work would cause no strain to the pedestrian a few lines of mechanised transport would adequately serve those who lived at a greater distance from their work. Generally interurban traffic could rely on buses and similar services which would not have to cater for large numbers of passengers at a time. The short distances between interurban aims of traffic could be maintained and would be furthered by a compact, rather than a stretched, shape of settlement. Zoning, theoretically speaking, could be applied fairly rigidly. Buffer zones, in the form of open areas or similar separations and boundaries, could be created between different areas where desirable.

Green zones and open areas could, again at least in theory, be so placed as to be in walking distance of all dwellings and might with advantage and economy be coherent. Eventually residential areas could be laid out in an open fashion and densities might be comparatively low. On the whole most urban needs can be provided for in a satisfactory manner in the medium size town without the extent of the town interfering and creating obstacles.

Now take the large town. Obviously it will not do just to enlarge the medium size town and to rely on a more efficient and amplified system of mechanised transport. Nor has that happened in reality. The large town is an agglomeration of several towns of different size and character, which forfeit their independence by its transmission to a common centre or several centres, as the case may be. These centres often emerge in the course of town development. Gradually they assume a part which depends on the existence of a number of urban areas that might be towns in size but are not in structure.

Such areas might provide both residence and work for their inhabitants but this is precisely what in most cases they are unable to do. Thus it happens that people live in one of these "towns" and work in another, which obliges them to spend much time on journeys to and from their places of work. If on the other hand large cities would consist of a number of practically self-contained medium size towns, grouped round a common centre and if, further, each of these towns could provide sufficient and varied occupation for its inhabitants many structural problems of the large city could be overcome.

In other words we might reduce the number of islands which compose the body of the present big town and have fewer and larger islands, each well related to others of different size so as to serve the

various purposes of industry, business and residence. Each of the envisaged residential units being the size of a medium size town would have its own industrial area, or areas, and would thus be enabled to offer varied occupation to at least the greater part of its population.

This subdivision which, in many cases, would already be indicated by the natural growth of a large town might be effected without complete disruption of the existing community. Nor would it entail complete separation of the new smaller towns from each other. On the contrary these might adjoin. Continuity of the urban area as well as a certain compactness of shape with relatively short communications could be preserved. Industrial areas would in principle remain islands as before, but there might be fewer and more concentrated island formations. These should be so situated as to enjoy the advantages of good communications while being well related to residential areas approaching the extent of medium size towns.

All this amounts rather more to a process of tidying up than re-planning. It is a suggestion, as far as the problem of location of industry in large centres goes, to make the existing town workable and it opens a field for zoning which would be neither over-ambitious nor impracticable. The small town is in many senses the unit for the medium size town; the medium size town the basic unit for the large town. This in essence is the plan.

There remains to be considered the case of business in the large town. Hitherto the concentration of commerce in the central areas has been the usual trend. More recently, however, a certain centrifugal tendency of business has become apparent. In London the westward trend of movement has been evident for some years; in New York similar developments have been observed. In several trades wholesalers have moved into closer vicinity with the retail trade and while it cannot be expected that business will be completely decentralised it must be assumed that this trend will continue.

The setting up of new business centres in different parts of the town would not be unwelcome, inasmuch as it would add to the varieties of occupation for the inhabitants of the residential areas to which these centres would have to be related. Generally, however, there exists but small room for hope for an even decentralisation of business in large towns. Business will always go to centres that for some reason have become prominent and are likely to attract many people. Thus a large town might develop several business centres

in positions where difficult traffic conditions already existed. Those adverse conditions would not be improved if business were to draw still greater masses of population into its areas.

This is one of the toughest problems for zoning and transport to tackle and since it is hardly possible to ban business from such already populous centres, local segregation seems the only way out. The vicinity of business and main thoroughfares is one of the major curses of many modern towns. Nevertheless, the public is appreciative of its seeming advantages, especially where shopping centres and establishments promoted by the entertainment industry are in close and easy contact.

Local segregation and the isolation of through-traffic from local traffic are very costly measures to put into practice; especially where through-traffic must be diverted from centres of urban life. They must, however, be faced. By suitable zoning, conditions must be created which will prevent business from moving out and re-settling at another place, with much the same results. On the other hand such business areas depend on the support of large masses of the public; large stores and warehouses can exist only at places which are visited by many. To maintain such business sedentary means of efficient transport must be at hand and also every convenience for the pedestrian. Shopping is in part a contemplative activity which should not have to suffer interference by traffic lights and the other paraphernalia and regulations of surface transport.

It is good to contend that centres for business and allied purposes as well as centres of entertainment should be less concentrated. Local centres are efficient and fulfil their task of serving local residents with commodities which do not require much freedom of choice. They cannot, however, take the place of large centres with their far greater variety of supplies. Those larger stocks with their greater variety offer the advantages of concentration and can be maintained only where customers come forward in large number.

Such areas require a special place in the structure of the large town and if they could be made to form larger islands well protected from through-traffic and yet within easy reach of all parts of the town they might function as intended with most of their dangers and inconveniences removed. These central urban areas should as far as possible be coherent; the dotting of the inner town with shopping centres—however well designed—will not suffice. That would be little better than the present state of affairs.

The residential areas which, so to speak, form the background of

the urban fabric do not present location problems in the aforesaid sense. They have been mentioned with regard to the general principles of use-zoning and their particular problems will be discussed later on. There remain to be added a few words on open areas as far as they concern zoning.

The provision of adequate open spaces has been consistently advocated for many years, but little practical work could be undertaken owing to the densely built-up structure of so many towns where the open areas were most urgently needed. Provision of these 'lungs' of towns during the rapid development of the industrial era had been badly neglected. There exist at present very few large cities with an adequate provision of open spaces. There was the fine tradition of the Georgian squares where terraces were grouped round spacious open screens, long before the row pattern conquered the field and district after district came to bear testimony to its deadly monotony. There were in London large open spaces, the property of the Crown and which are now among the most precious possessions of the community. There was in short in this country a great tradition which must be revived.

From a zoning point of view two types of public open areas must be distinguished. There is the large coherent green zone which stretches for a considerable distance and there is the small open space, the public garden, the small park, the small common green within easy reach of a group of houses or a block of flats. The former is an entirely public affair; the latter may have a semi-private character and serve, primarily, the needs of local residents.

Proposals for large open areas in big towns are often made in the form of green belts and wedges or as combinations of both. These have their advantages but it would seem that coherence in this case has been too strongly emphasised. It must be borne in mind that local residents in the immediate neighbourhood of such areas would draw the greatest benefits from them; and that in order to give easy access to these open spaces for other members of the community good distribution over the entire urban area is required. This then again becomes a problem of location and consequently must affect zoning.

In practice, alas, every effort to achieve a more satisfactory distribution of large open areas will encounter formidable obstacles. Most prominent is the merciless fashion in which urban land was too closely covered by buildings in the past. To clear large areas lock, stock and barrel, and to leave the cleared area to serve the

urgent want of open spaces will be possible in very few instances only. Some help might come from the small semi-private open green.

There are more weighty reasons in favour of small intermittent open spaces in the close vicinity of dwellings. One justification is their practicability. They can in fact be provided anywhere and may be based on a long-term policy without involving heavy complications. They are extremely useful in helping to loosen the urban fabric and to admit an equal amount of sun, light and air to dwellings. From the resident's point of view they have the immense advantage of being near his house or flat, so that he has only to walk a few steps to be out in the open: nor is that convenience underrated by the tired worker in office and factory who has only a few evening hours to spare for outdoor recreation.

As it is both types of public open spaces are essential. The ideal is an adequate provision of several large green zones well distributed, reinforced by many small common greens widely dispersed over the entire town. Since the war it looks as if this aim has become more realistic than for a long time before. And while this great chance has been paid for dearly there could be no finer monument to human sacrifice in the big towns of this country than open spaces well laid out for the use of all.

#### 4. RESIDENTIAL AREAS IN RELATION TO BUSINESS AND INDUSTRIAL AREAS—BUFFER ZONES

In 1901 a young Frenchman, Tony Garnier—to whom the Grand Prix de Rome was awarded—submitted to the Commission appointed to select the successful competitor, a most unusual scheme, namely, a complete design for a modern industrial town of 35,000 inhabitants.<sup>2</sup> This remarkable project anticipated many of the ideas advanced by successive planners and theorists. Garnier introduced a clear separation of industrial and residential areas by means of a green zone and he may claim to have been one of the first planners to make use of green areas in this way.

His residential districts were laid out in ribbon fashion, on either side of a main artery for inter-urban communication leading to a point outside the town where it joined the main artery of the industrial area. Here Garnier planned his railway station and close

---

<sup>2</sup> *Une Cité Industrielle*, Tony Garnier.

to it the business centre, both on the same side of the separating green zone as the residential town. The residential zone has the character of a garden city, well proportioned and orientated, with a carefully considered communal centre. Hospitals are planned outside the town to make the best possible use of healthy air. The industrial zone is designed independently and can expand according to its own requirements.

The open green zone which in the scheme of this forerunner separates residence from industry appeared in the 'twenties in Russian schemes for new industrial towns. These were based on a conception known as the "linear town." Its guiding principles were the relations between industrial and residential quarters, as well as the appropriate development of each district in itself and, furthermore, a system of communications which could operate with a minimum of mechanised transport.

The area of the town is divided into a number of parallel ribbons representing zones of different structure, industry, residential quarters, and so forth. The town extends in two directions and the lines of mechanised transport run parallel with the different parallel zones. While short walking distances from ribbon to ribbon are secured, the lines of mechanised transport are crossed by pedestrian traffic at numerous points. A green zone of no less than 500 metres width separates the industrial and residential quarters. Theoretically, places of living and places of work are thus in walking distance from each other.

Like Garnier's linear town this linear town of the Russians was not meant for application to larger settlements when, because of great distances between the parts of the town and the long-stretched system of communications necessary to overcome them, this pattern would be uneconomical. Attempts to apply this plan conception to problems of the big town have not been convincing.

The use of green zones as buffer areas between residence and industry is not limited, however, to any size of town and will, it is to be hoped, become general practice after this war. Such buffer zones should be introduced in all those cases where it is imperative to separate industrial islands from adjoining residential quarters. Protection from noise, smell and air pollution is necessary, a requirement which affects a number of light industries such as certain branches of the production of food. The width of this protective zone, obviously, must be determined in each case; in many existing



towns such generous dimensions of separating green areas as in several of the Russian schemes will hardly be possible. Often the setting back of building lines and suitable planting in front, leaving a protective strip of green of 150-200 feet width will have to suffice. If minimum dimensions are to be mentioned in this connection it seems that no width of less than 100 feet should be contemplated and that only in regard to inoffensive industries.

The larger the industrial islands the easier might be the problem of creating suitable buffer zones. In areas newly developed for a limited number of inhabitants, in connection with a few industries, buffer zones should hardly present great difficulties.

Often, however, the planner will have to look for substitutes to replace green areas as buffer zones between residential areas and industry. In that search he may have to fall back on existing boundaries between urban areas such as are afforded by the network of streets and other communications. Local shopping centres, office buildings, etc., might also be suitable though on the whole all these substitutes will be rather inferior to the protective green strip.

Further to be considered in connection with buffer zones are the possibilities for industrial islands to expand and in that connection zoning regulations must be so framed as to make adequate provisions. This might be done by adding a margin to land reservations set aside for industry and, in special cases, by encouraging vertical development such as flatted factories to provide for a better utilisation of building land than the usual horizontal spread of industry permits. Measures of this kind are exceedingly difficult to frame and even more difficult to apply; the most far-sighted planner may yet discover that he has put the requirements of to-morrow either too high or too low.

There is, moreover, no doubt that industrial processes become increasingly cleaner and less dangerous to health and there may come a time when the relation of industrial and residential areas will be merely a problem of transportation. As regards business areas in relation to residence, buffer zones, in the above-mentioned sense, are hardly necessary. They can be dispensed with also in the case of business and industry. It is therefore feasible to develop new urban centres of the self-supporting kind in a threefold sequence: residence, business, and industry, with the business area acting as buffer zone between the residential and industrial areas.

## 5. ZONING AND TRANSPORT

The satisfactory application of zoning regulations depends very largely and often, ultimately, on a network of communications capable to maintain traffic between the several areas of the town. This is a matter of road layout and concerns in no small degree the various systems of mechanised transport. It involves the close co-operation of traffic specialist and town planner, and though use-zoning<sup>1</sup> is the primary aim it is often imperative to make concessions to traffic requirements.

In existing towns, which may badly require re-zoning and re-location of business and industries, planning work is often checked by the formidable obstacles which an existing grid of roads, water mains, and sewers may impose. All these are costly to provide; and once in commission they are in many a sense as rigid as the skeleton of the body. The attitude of town dwellers to the roads and streets of their town is one of extreme conservatism and it is surprising how old are many of the roads in large and ancient urban centres. Their functions have changed, their houses have been replaced more than once or twice, and yet they preserve much of their shape and even much of their character. And this notwithstanding that with their ancient importance gone many of them became, with each new generation, more and more useless and eventually nothing but defects in the system of road communications.

The task of the transport specialist is to keep the large and small arteries of urban communications efficient and in a position to fulfil their duty. During the last five decades the network of road has grown immensely with the extension of the cities. A state has now been reached where the large arteries are increasingly unfit to meet their obligations. This, in large cities, is a case for surgery; a series of painful operations will have to be undertaken and they will require considerable time.

There is little doubt that more than one generation will pass before this tremendous undertaking of revitalising and rejuvenating the large cities can be completed and master plans will have to be continuously amended as the work proceeds. In such cities zoning will be influenced extensively by transport requirements, but its preponderance must not be impaired. After all, transport is a servant and makes but a bad master and there are circumstances when the argument for economy must be challenged. Suitable allocation of urban land for the various purposes of urban life and

a satisfactory relation between areas of different structure are the primary consideration. Where this work is imperilled by an antiquated and ill-fitted road layout, or other equally obstructive systems of communication, these impediments must go. The initial cost of operations may be high; but in the long run it is cheaper to remove obstacles than to by-pass them or, worse, to allow them to accumulate and to narrow down the space required for healthy urban life.

Similar considerations apply to other systems of communications and in particular to the railroads of interurban traffic. These often, where they are not in the least necessary, create formidable barriers and separations. Stations and yards occupy areas of a size that might excite the envy of industry and business alike, and in some cities, it has been suggested, they exceed by far the amount of open spaces. Greater impediments to zoning cannot easily be imagined.

Transport in large cities has simply been overtaken by urban growth; without central control there could not be a far-sighted plan and patchwork was the inevitable result. Some planners, despairing of all hope of remodelling urban transport and the existing skeleton of large towns have proposed to pull down and to build afresh in accordance with contemporary principles. Before this war schemes of that order might have been discussed though, even then, when there was neither exhaustion nor shortage, any enterprise of that size might have exceeded the capacities of urban communities. After this war, however, when the provision of accommodation will be among the first tasks of reconstruction; when planning will necessarily operate on a long-term policy; and when, nevertheless, important principles will have to be decided without delay, an all-out solution for the problems of large cities such as wholesale pulling down and rebuilding will hardly be possible. Even where a large part of the built-over areas has been destroyed there is a network of roads and services in existence which in its major characteristics will still be useful.

The task of reconstruction is a matter for compromise. While it is desirable and important to retain in existing large cities association with an ancient culture and tradition re-zoning, and the re-planning of transport, must not be subject to interference. There is wide-spread belief that the existing town is not doomed and that its defects can be eliminated. Among those defects is inefficiency of transport and more particularly surface transport.

## CHAPTER II

### ROAD PLANNING AND TRAFFIC

#### 1. NETWORK OF COMMUNICATIONS

URBAN traffic is determined by the means of communication and their respective networks while these in turn, depend upon the shape of the town and the relation between its various areas. Generally, there is a radial movement of traffic from the outskirts to the centre, and *vice versa*; there is through traffic and unclassified traffic all over the town in different directions, between various points.

The first of these is the largest in volume especially during peak hours. Other kinds of traffic, less formidable in extent show greater continuity. The volume of through and radial traffic can be measured with comparative ease; it is the volume of unclassified movements with their enormous variety of aims which creates difficulties and complicates planning. The problem, in the latter case, is to ensure that sufficient traffic is picked up by the provided system of communications; otherwise economy cannot be achieved. On the other hand existing facilities might not answer demand and the traffic would seek its own ways through areas where it is least wanted. Both those defects occur in actual practice, and while waste is the chief symptom in the former there is the danger of congestion in the latter. Through traffic must be kept free from contacts with other forms of traffic except where desired; radial traffic must be prevented from causing congestion in the centres of towns; unclassified traffic must be given sufficient facilities so that it can avoid either waste or congestion.

One of the most difficult tasks in planning urban communications is to estimate the amount of traffic they will have to cope with and to consider possible trends of future development. This, to allow for economic layouts, can be achieved only in close co-operation with zoning. In the past there was not enough differentiation of roads. Thus it happened that residential roads and streets were frequently over-dimensioned while main arteries, and other major

36 PLANNING AND TRANSPORT: EFFECTS ON INDUSTRY AND RESIDENCE  
roads, became increasingly unsuitable for their purpose owing to their insufficient width. Differentiation is most essential and almost an axiom of sound planning; it is the best guide to efficiency and economy.

The various systems of transport may be divided into two groups—those which use the surfaces of existing roads and streets and those which possess a network of communications of their own. Roads and streets are shared by pedestrians and mechanised transport alike without much segregation. This kind of traffic is the most problematic and dangerous. In the case of mechanised systems of transportation, with a network of communications of their own, the task is mainly one of providing satisfactory relations and ensuring sufficient numbers of passengers. Surface and underground railways which are designed to cater for a large volume of traffic cannot work economically if a large percentage of the seats which they offer to passengers daily remains unused.

Next there is to be considered the relation between the several networks of communication and the shape of the town. It has sometimes been contended that the shape of urban areas should be governed by its transport requirements and one of the theories of town planning which originated from these conceptions is that of the lineal town, or the ciudad lineal as its author Señor Soria y Mata called it. In principle, to the linear town of the Russians, it comes very close, though based on the assumption of a highly mechanised and efficient system of transport and thus meant to apply chiefly to the big town.

Señor Soria y Mata<sup>3</sup> visualises an arrangement of dwellings and places of work on either side of a spinal system of traffic lines. The several areas, residential, industrial and business, would be limited in depth of extension to ensure short walking distances from the outskirts to the centre spine and to reduce pedestrian traffic to a minimum. This lineal town would extend in two directions only, being restricted in its width and it might thus reach excessive lengths. It must be admitted that this suggestion manages to exclude the necessity of frequent changes of direction of traffic which is inevitable in the case of a more compact shape of town; also, that the number of crossings can be reduced to a minimum or even be entirely eliminated. On the other hand, distances

---

<sup>3</sup> *Conception of the Ciudad Lineal*; Don Arturo Soria y Mata. *El Progreso*, 1882.

between different points in the town tend to be very great indeed and while the lines of communication will have to cope with heavy traffic during peak hours their length and expense will not be justified by the decreasing flow of passengers during normal hours of the day. For these latter passengers who, in more compact towns largely contribute to unclassified traffic, there will in Señor Soria's town be the added inconvenience of longer periods of travel. It might be argued that in the lineal town trains, for instance, may run at higher speeds but it is the distance between stops and the spacing of stations which have to be considered. And these must be planned and spaced to serve the convenience of the traveller and, in the lineal town especially, to reduce distances of walking.

If, on the other hand, the structure of the town were much loosened and the stations further apart there might be danger that the system of transport would not be used economically. Railroads require a very large volume of traffic and would therefore be the wrong proposition for so vastly stretched a town; bus services might probably be the better solution, but here again there are the difficulties of an increased traffic during peak hours to be coped with. On the whole it does not look as if the lineal system of town would in reality so greatly improve traffic conditions in large urban communities as it is sometimes claimed.

Señor Soria's town which is still a child of the last century—it was conceived in the 'eighties—has made a reappearance in Linear London and later in the plan for London prepared by Mars (Modern Architectural Research Group). There is some similarity between the principles of the *ciudad lineal* and a certain form of ribbon development, as it appeared so frequently in the more recent past. This comparison is, perhaps, based on facial similarity rather than on actual structure because, in the lineal town, the central spine of traffic would be neither dangerous nor injurious to amenities, a depressing defect which occurs frequently with ribbon development alongside the main highways of transport radiating from big towns into and across the open country.

Ribbon development may be regarded as a result of the influence of mechanical transport on the extension of urban areas—the radial sprawl alongside the main arteries of traffic having superseded the more concentric tendencies of expansion in the past. Where modern towns continue to grow they extend radically rather than concentrically unless lineal development parallel to the

highways of transport is reduced and a sufficient measure of concentric communications—ring roads or similar—is provided. This would strike a right balance between concentric and radial extension and prevent distances becoming needlessly excessive.

From this last point of view a compact shape of town is obviously the most advantageous and though traffic in such a town would have to rely on a network of communications comparable to a spider's web, as against the unilineal system of traffic in the "ribbon" town, it might still be preferable to the latter for several reasons. There are, first of all, the relatively short distances of travel which, at least in theory, exist or could exist in towns of compact shape. There are secondly—always comparing the compact with the lineal shape of town—the shorter lengths of communications and consequently the greater economy of installation. Thirdly, owing to the greater capacity of a network of transport in spider's web form to pick up a sufficient volume of traffic, classified and unclassified alike, there is better chance of a more evenly distributed use of mechanised transport. Put differently, the percentage of unused seats offered daily by various means of transport might be kept at an economic minimum.

Thus in theory it seems that from a transport point of view a compact shape of town is satisfactory in spite of certain drawbacks. These are the difficulties of segregating the several forms of traffic where desirable; further, the problems of crossing which arise wherever two different lines of traffic meet; and lastly, there is some danger that concentric or ring communications—costly to install—will not be used to full capacity.

In reality, of course, few of the advantages which a compact shape of town offers have been fully exploited. Nor could they have been owing to the reasons for urban disorganisation already discussed. The compact shape was blamed for many shortcomings which sprang from entirely different sources and, similarly, the spider's web system of communications was marked down for inefficiency especially with regard to its ring connections. It may be added that most large towns in their development show a definite tendency towards compactness and that with the introduction of machines into transport essential planning principles and precautions were neglected. This neglect is responsible for the existing dismal conditions of traffic, not the shape of the towns.

The most difficult problems affect surface traffic on the roads

where hitherto segregation of forms of transport was for all practical purposes unknown. Lack of sufficient differentiation in the network of road communications has already been mentioned, and, furthermore, there is an apparent lack of clear definition as regards the varied uses of the roads. The multi-purpose road is a dangerous road and though it cannot be excluded from the layout it should be reduced as much as possible.

Next there is to be considered the variety of layout patterns for urban areas. Of these there are many. Most are in one way or the other tied up with different periods of development; their various trends of design are in accordance with the requirements of the day. Thus we have the irregular layout characteristic of a slow and steady growth, especially frequent in medieval towns. This irregularity, however, remains merely an irregularity of the road plan without affecting the structure of the town. It is often dictated by the properties of the urban site, by slopes and hilly land and by endeavours to adapt the delineation of the roads to the contour lines of the site.

Where urban areas must be planned on sites that are not flat, irregular layouts fitted to the contour lines are compatible with the principles of sound planning. On flat sites, on the other hand, the irregular pattern is not really warranted and is likely to produce forced effects which cannot be justified except by misguided romanticism. On the whole irregular layouts are variety itself. Though we may discover in some of them elements which are typical of the regular pattern like the carfax, they are entirely a product of the site to which they are related.

Most of these irregular layouts are not of modern date and in regard to transport they present considerable difficulties and dangers to safety. In existing large towns it is to such areas that the principles of urbanistic surgery must be applied in the widest possible degree; they should be separated from the highways of traffic as much as possible.

The regular street pattern, the chessboard type, or the gridiron, is scarcely much younger than the irregular layout. In fact they go back to the remotest periods of antiquity. They were known to the ancient Egyptians and employed by them to settle and house their workmen economically, as may be studied in the 12th dynasty town of Kahun and in the 18th dynasty workers' settlement near El Amarna. Later the Greeks made use of the gridiron during



their periods of colonisation. The discovery of this pattern they attributed to a certain Hippodamus, a native of Miletus who lived and practised during the 5th century B.C.

The Roman town with its quadrants and main streets crossing in a carfax and following the directions of the cardinals is, of course, well known. Other examples of the regular layout are found in ancient India and China. In Europe the gridiron recurs in the later Middle Ages when new towns were founded and built to pre-determined plans. The Bastides and Villes Neuves of medieval France, founded by the English and the French in the 13th century, are in their majority of regular shape with gridiron and central market squares.

Town planners of the Renaissance developed several other varieties of regular pattern by experimenting with polygonal and radial layouts, the latter going back to the conception of an ideal town by the Roman architect Vitruvius Pollio. Though comparatively few new towns were founded in Europe during the Renaissance, and in the centuries which followed, they presented planners with an opportunity to prove their principles in actual practice. The radial system of layout and the introduction of the diagonal street into the chessboard pattern are the outstanding features of this new development in town planning.

Sir Christopher Wren's plan for the rebuilding of London after the Great Fire of 1666 shows a free use of both principles, whereas in the layout of Versailles the predominance seems to rest with the radial system. These conceptions found a wider application in the New World where the radial system and the diagonal street introduced by French town planners soon superseded the older gridiron. In the layout plan of Washington designed by L'Enfant, in 1790, two axes intersected at right angles form the basis of a layout plan where the gridiron and the radial system were employed in combination.

The gridiron either in conjunction with the diagonal street or the radial system which thus became a typical feature of modern American cities is, however, no satisfactory pattern for modern urban traffic because of its many intersections. Moreover, it offers no solution for problems of unclassified traffic and its tendencies to spread over the entire urban area. It is in fact a pattern of the pre-industrial era and is not designed to cope with the requirements of mechanised transport.

On the other hand the gridiron is still suitable for subdividing urban areas scheduled for purposes which will not bring them into contact with the main flow of traffic. In residential areas the rectangular layout has great advantages in securing equal conditions as regards size, orientation and access to individual plots. It also facilitates a suitable differentiation of roads and secondary approaches and in general makes for an economic layout, the more so if the basic unit of the building block is a rectangle or near rectangle with two long and two short sides.

In practice the term gridiron should not be interpreted too literally—this has unfortunately often occurred in the past—but rather as a general principle that might be modified according to circumstances. Such a free interpretation of the rectangular plan would allow for its adaptation to most sites while the initial advantages of the layout would not be lost. This pattern has its place still in the layout of the town though, in our time, this is a far more modest place than in the past.

For the planning of the main arteries of traffic in a big town the combination of radial plus circular roads has become an accepted principle. With more or less variation this pattern has been employed in the replanning of big centres in recent years. One of its great advantages in application to existing towns consists in its adaptability and in the fact that, usually, radial arteries can be provided with comparative ease by using existing connections and fitting them for their new purpose. Greater difficulties are encountered in planning the circular or ring connections where care must be taken to ensure that these roads will be properly used and that traffic will not seek and find shortcuts.

The problem of ring roads intimately affects zoning for, while the traffic specialist may succeed in producing an entirely workable design, it is zoning which determines the volume of traffic and the economy of layout. Barriers may be constructed and the traffic forced to use some roads and avoid others; shortcuts may be rendered unattractive but restrictions are not sufficient and, indeed, are only admissible where nothing better can be done. The ideal is, of course, the road which not only suggests to the traveller that he is taking the shortest way but actually is so.

In existing cities there is usually a great variety of layout patterns of which the majority obstruct the requirements of the motor age. That is to say they are obstructive because they are not designed to accommodate high-speed traffic and to permit segregation of traffic

according to speed. This not only refers to the geometry of the layouts but in no small degree affects the particularities of the roads themselves, their lengths, widths and intersections.

The mechanisation of surface traffic has reached a stage where the question of a separate network for high-speed traffic can no longer be postponed. Up to now motor transport has, so to speak, been a lodger and had to share in a network of communications designed for the needs of pedestrians and slow-speed vehicles. This has not only resulted in an ever-increasing roll of casualties but in continuous experiment, also, with speed limits far below the capacity of vehicles. The present speed limit of 30 m.p.h. may have its good points and is certainly a great improvement on previous figures but is still considerably below the average speed of vehicles on unrestricted roads.

The low speed limit in urban areas is reflected in the cost of transportation. Motor vehicles that cannot travel at the speed for which they are designed are wasteful and cause unnecessary expense. It has been estimated that in some cases this waste of speed increased the cost of transport in urban areas by almost one-quarter.

This, then, is a problem of enormous importance. Urban life nowadays depends on mechanised transport and it is essential that this should work economically. The obvious answer is segregation of the different forms of traffic according to speed. High-speed traffic must have a network of communications of its own. There should be three different networks of surface communications: one for high speeds, one intermediate and one for low speeds. In other words there should be a network for major roads, for minor roads and for residential or other local roads.

Between the three systems of network a clear separation should be made. Contacts should take place at certain junctions only and the minor roads should act as intermediates between major and residential roads. Junctions and intersections of major and minor roads should be dealt with by roundabouts, fly-over bridges, clover-leaves or any combination of them. These principles are nowadays so widely recognised that they need no further elaboration.

With due respect to the radial plus circular pattern of road layout it must, however, be said that application of the principle of three different networks of urban communications appears not to depend on any particular pattern. It is possible to imagine other layout systems which, with equal advantage, would permit the use

of this principle while they might offer special advantages in other directions.

The radial plus circular layout is in many ways a layout for the big town, in particular the existing big town, where surgical treatment of the transport conditions has become a necessity. In smaller towns with perhaps one or two major, several minor, a multitude of residential roads and a clearly defined traffic, other patterns seem more appropriate and less ambitious. A modified and adapted gridiron would probably be adequate and where, in existing smaller towns, there should arise traffic problems insulation of the main artery of transport would be a sufficient remedy.

Our time, fortunately, is not very pattern-conscious and the variety of problems has, on the whole, not stimulated any trend of this kind. Though, in given cases, solutions of planning problems might assume a typical character there is no seeking for a panacea. It hardly requires stressing that the remedies for transport questions affecting the big town are not fit for application to smaller towns. General principles must be modified and re-interpreted in each case.

In actual practice introduction of speed segregation into the traffic system of existing big towns will be largely a matter for adaptation and compromise. Not always will it be possible to re-define the functions of roads. Other solutions must be sought. Such are the separation of pedestrian and motor traffic by different levels, by arcading, by utilising secondary roads running parallel with main arteries for pedestrian access to buildings between both, and so on.

Mr. Alker Tripp<sup>4</sup> has made a suggestion in regard to the segregation of traffic which might find widespread application, the more as it is entirely practicable. His idea is based on the creation of numerous "precincts," areas consisting of a system of local roads sealed off the main arteries of traffic and communicating with them indirectly by means of intermediates or minor roads. The minor roads would contact selected local roads and in turn be connected with the major roads at certain specified junctions. No part of a precinct should be more than a quarter of a mile from a line of motorised transport; and thus, as Mr. Tripp points out, there should exist within the quiet confines of the precinct conditions not unlike those in the Inns of London.

The one and only objection which might be raised against this

---

<sup>4</sup> *Town Planning and Road Traffic*: H. Alker Tripp (1942).

scheme is mentioned by Mr. Tripp himself. It is, that strangers might easily lose their way in these precincts and generally experience difficulty in getting about them. There might be instances where an intricate layout would present some difficulties of this kind; on the whole, however, the disadvantage is negligible.

The conception of the precinct, the quiet island in the maelstrom of urban traffic, opens new ways of planning and in particular residential areas should draw large benefits therefrom. Its application, however, to business and industrial areas is hardly less important. Here is an effective cure for many obnoxious traffic problems of the big town which is much simpler and far less costly than the separation of high-speed traffic from low-speed traffic by a system of elevated roads which some planners—among them the architect Le Corbusier—have suggested.

Mr. Tripp's plan is not as radical as the plans of these theorists. It relies on roundabouts, and traffic signals in the main, and on an effective closing of the road ends of residential and other local roads where they link up with high-speed arteries. His scheme is a compromise though an efficient one; and moreover it can be put into practice. The precinct corresponds in many ways with the large building block surrounded by residential roads and opened up by secondary approaches, which will be discussed later on. Thus there will be possible a continuous gradation of traffic in relation to speed from the major and the minor road to the residential road and the secondary approach.

Precinct planning has been successfully employed in some residential areas and it may suffice here to recall the magnificent effort of Messrs. Henry Wright and Clarence Stein at Radburn, New Jersey. Radburn, built in 1929, is the first modern community where a rigorous segregation of traffic according to speed was achieved. Pedestrian and motor traffic were completely separated and by means of footpaths with underpasses and bridges pedestrians can walk from one end of the community to the other without coming into contact with motor traffic.

In Radburn, furthermore, interior parks were planned within the precincts in relation to a school, a playground, and a swimming pool. The precincts are opened up by means of secondary approaches, *e.g.*, cul-de-sacs, and this pattern was carried through with greater consequence than anywhere else. Precinct planning of this kind is, indeed, most promising and can be employed

practically without limitations. A word on cost may be added, though this matter will be dealt with in some more detail later on. In the development of new areas on the precinct principle, cost can be reduced considerably as only secondary approaches will be employed for opening up the site, which would be bound by several residential roads. The use of a more convenient and more economical form of land subdivision on these lines would also reflect favourably on the frontages of individual plots, which, without extravagance, might be widened and consequently would permit of more satisfactory floor plans of houses.

In existing areas it is chiefly amenities and safety which must be aimed at by precinct planning for it is obvious that with existing development there can be no question of saving cost. In point of fact the soundness of Mr. Tripp's conception in its application to existing layouts is greatly strengthened by the chance it leaves to make the best possible use of existing development within the precincts. This does not refer to buildings many of which will have to come down; but it certainly concerns the existing grid of local roads and services. Many of these will continue to function and would be lined by new buildings—residential, business and industrial.

With regard to the inevitable island structure of large urban centres precinct planning would assist in zoning. There should be no precincts of mixed structure, e.g., industrial and residential or residential and business. The use of business areas as buffer zones between residence and industry has already been mentioned; precinct planning might further this purpose.

In regard to open areas the Radburn example of interior parks within the precincts commends itself. There arises, however, the question of maintenance of these inner common greens. Unless they are publicly maintained the scheme would not work.

Some of the more radical attempts to achieve a satisfactory segregation of traffic according to speed may be mentioned. There is Richard Neutra's town—an early attempt—with its separation of pedestrian and vehicle traffic at different levels and its continuous system of elevated footways and bridges, at intervals, for crossing the street. There are Le Corbusier's plans for Algiers and Anvers, as well as for several other towns, with bold systems of overhead highroads for high-speed traffic, leaving the ground area for slow-speed and pedestrian traffic—the exact reverse of Neutra's

plan and of the similar plans of other theorists. The overhead highroad seems to be favoured by some planners and it might have some advantage as regards cost. But its chances of application in large urban centres are limited because of their density of structure. Besides there would be many difficulties in linking up these highroads with the networks of subarterial roads.

On the whole the application of schemes of the types thus briefly summarised will probably be exceptional rather than a rule, and if one considers the problems which far less ambitious systems of road regulation will have to overcome it would appear there is little hope for the bolder schemes.

## 2. CLASSIFICATION OF ROADS

The subject to which we next proceed has been touched upon before. It may now be discussed in detail. Generally, distinction is made between three basic types of roads: A roads or major roads; B roads or minor roads; and unclassified roads, an extensive class consisting of residential and other local roads. This distinction applies to any layout pattern of town. From the classification of roads and the necessity of segregating traffic according to speed there arise the three different networks of surface communications to which reference has been made above.

The design of the three networks and their respective roads is the job of the traffic specialist and the road engineer. It is their business to specify lengths and widths of roads, distances and types of intersections and junctions, and methods of solving particular problems. They will, however, depend in their work on the co-operation and the advice of the town planner and the zoning specialist. In particular the two latter must be counsel in all matters concerning sizes, proportions and types of building blocks.

By-pass roads, ring roads, diverting traffic from the centres of large towns, and a certain number of roads leading from the outskirts to the centre should all be major roads. Designed for long distance and high-speed traffic they should be kept free from contacts with low-speed transport, especially pedestrian. They should be so delineated as to connect urban areas between which there would be a continuous movement of traffic; were they merely to attract traffic or, worse, to divert it from its natural routes they would badly serve their purpose. They would not then assist to reduce the costs of transport.

The problem of building frontages on either side of these major roads is one of great difficulty. Traffic specialists like Mr. Alker Tripp insist that there should be no access from these roads to any buildings whatsoever. In existing cities this might sometimes be difficult to accomplish. Where, however, compromise in this matter has to be accepted a slowing down of speed of traffic will be inevitable.

The major roads would link up at certain junctions with the network of the minor roads and these, in turn, would give access to the network of local roads which themselves would serve a number of secondary approaches. On minor roads speed limits will probably have to be accepted and also—especially in existing cities—building frontages.

In this system there will be comparatively few junctions and intersections. In various ways these might be negotiated according to their importance. There is first of all the roundabout which combines general efficiency with relative economy. Then there is the fly-over bridge at the intersection of two arteries of heavy traffic, a rather expensive solution, especially if it is fully developed with ascending and descending ramps to serve the change-over from one direction to the other.

Apart from cost there is another advantage with the roundabout as against the fly-over bridge. The former can control a number of roads from various directions whereas the latter is generally restricted to an intersection of two roads. There is further a combination of fly-over bridge and roundabout, which has the advantages of both systems and would require less space than the fully-developed fly-over bridge or the cloverleaf.

In the design of the network of local roads traffic considerations of this kind play a less important part once the segregation of high and low-speed traffic has been carried through. Local roads may be sub-classified, and in residential areas especially a number of secondary approaches have been developed. These are the cul-de-sac, the through-access road and the loopway. The footpath which can serve as a means of access to individual sites may, in some instances occasion great inconvenience in respect of deliveries of goods normally made by car. Footpath access is equally unsuitable for the removal of refuse from individual houses where the dustbin system is used.

If the three basic networks of surface communications could



replace the tangle of communications in existing cities not only would there be gains in safety and convenience, the cost of surface transportation might be considerably reduced. In reconstruction schemes for some of the larger towns of this country important steps have been made towards the establishment of workable road plans. Though many compromises had to be accepted and were, indeed, inevitable, considerable improvement can be expected.

These schemes give some idea of the extent of the surgical treatment necessary in modern towns if road plans are to be brought up-to-date. It will take a long time to put them into practice. Road widenings, roundabouts, fly-over bridges and other elements of modern traffic planning are costly to provide and require a series of complicated operations. In the meantime urban life goes on and produces new problems. Zoning must needs be elastic, far more elastic in fact than the road plan.

In times of steady development and gradual technical progress the rigidity of the streets layout presents no great difficulties. In our time, however, there is neither steady development nor gradual technical progress. *Before the last war the car was a small menace, to-day it is a major danger.* Though the roads were already overburdened before 1914 road planning was completely left behind in the short period between the two wars. A similar thing may happen after this war.

This conflict between the changing requirements of urban life, the technical progress of transportation, and the rigidity of road planning must be accepted. No perfect road plan can be conceived and none that will not sooner or later be outdated. Here we touch on the fundamental problems of urban life. Will it be possible to co-ordinate the various elements of urban life so that road planning would not lag behind? The answer up to a point is in the affirmative. Success rests entirely with the extent and working of the necessary controls. Any compromise in this matter will seriously prejudice and imperil the result.

### 3. MECHANISED TRANSPORT WITH SEPARATE NETWORKS OF COMMUNICATIONS

Beside the mechanised transport on the roads there are other systems of transportation which possess a network of their own. Their problems are mainly those of faulty growth or age, coupled

with incapacity to cope with increased requirements. There is the competition which is the result of faulty planning insofar as both forms of traffic often run side by side, or at any rate close to each other, thus leaving the traveller to choose between them. His choice will be determined by the distance he has to travel and the greater or smaller convenience expected to be experienced on the journey by one or other of the two transport systems. Or seasonal considerations will have influence. It is known, for instance, that in summer the underground railway loses a vast number of passengers to the surface transport.

However this may be, the competition of different forms of transport is not only uneconomical but utterly unnecessary. The fact that the public should have been given two or three different systems of transport, all serving more or less the same routes, and that for one seat used during normal hours in one system another seat may remain unused on another system is one of the great absurdities of urban traffic operation. The number of unused seats which London Transport offers daily on its various systems of road and rail transport must be very high. It would not be surprising if that figure should approach one-quarter of all the seats offered.

At peak hours, of course, the picture is quite different, at any rate in certain areas. About half a million passengers travel daily from the outskirts of London to its centre and this tremendous traffic is compressed into a few hours in the morning and at night. To cope with such numbers all systems of mechanised transport must co-operate and the services must strain their capacities to the limit.

All transport systems that must be dimensioned for rush hour service are eventually wasteful, unless they manage to pick up sufficient traffic during the other hours of the day. There are two methods to approach this problem. One—which, incidentally, was recommended particularly in wartime—is the staggering of the hours of work; in theory a practical solution, in reality, however, only suitable for small-scale application because of the inevitable hardship for those who would have to start work later and leave later than others. It might operate on a rota, but the system would require complicated machinery; its universal adoption runs counter to popular ideas. In some Russian cities it has been tried out but apparently without much success.

The other method is that of decentralisation. Being so well known this need not be elaborated here. Its chances of success are

somewhat limited. While industrial decentralisation presents no unsurmountable problems for zoning it is business, and especially business in the central areas, that creates the obstacles. There can, of course, be no question of decentralising the various "cities" or commercial centres to the same extent as may be done with industry. As already mentioned, commerce often has parasitical tendencies with regard to location and tends to settle at centres which, for some reason, have become prominent. At present there are in London two main commercial centres, the City and a considerable extent of the West End.

The migration of business from the City to the West End was gradual and has had its bearing on the former. Obviously the planners of the reconstruction of the City have taken this into consideration. If there were other centres of similar importance like the West End a further decentralisation of business would undoubtedly result. In other words, if a large town like London could be subdivided into a number of medium size towns the development of several business centres of importance could be encouraged, and the daily stream of office workers be decentralised.

To put a question is not to find an answer. The problems raised by the systems of mechanised transport which cater for large numbers of passengers are among the oldest and most difficult of the contemporary big town. Only a few years after Shillibeer had introduced his omnibus services there appeared, in 1834, the first railway in London. Installed in Marylebone Road, three years later London possessed almost four miles of railway. Only twenty-three years after that memorable event the first underground railway was opened, its engines driven by steam through smoky tunnels. Paris followed London's example as late as 1900. In New York the southern end of Manhattan was already, in 1864, connected by rail with the northern end of the town. Unfortunately the expansion of the towns continued with such rapidity that the lines of mechanised transport of the kind indicated—which might have been a guide for extension—had to follow the haphazard growth. Neither properly laid out nor co-ordinated they entered into competition with each other. Consequently they were for the most part uneconomical.

Out of these and similar beginnings grew the networks of inter-urban rail transport. In fortress towns like Paris strategical considerations were a further impediment to sound development of

mechanised transport, leading to the provision of circumferential railroads which later proved so uneconomical and carried so few passengers that, eventually, they had to be abandoned. Built in 1851 the central metropolitan railway system proved increasingly unable to compete with less wasteful systems of transport. In 1934 the service was discontinued. That, it should be emphasised, is a danger which might occur with the gradual disuse of circumferential traffic lines, ring roads, etc., that were not well defined in their function and unable to pick up enough traffic.

Rail communications in most large towns, run at a loss. But their great advantages are speed and their capacity to move large numbers of passengers at a time. In densely built-over areas with large populations rail communications are preferable to all other systems of surface transport, especially in regard to peak hour traffic. That the underground railway has held the field so consistently in many large cities is deplorable for it is by far the most costly of all systems and, had a cheaper method been employed, a more efficient network of railroads would have been available. The costs of installation of an underground railway system are more than double and sometimes exceed more than three times the cost of an overhead railway which offers far greater amenities to the traveller. The underground railways offered a means of making the best of a bad job at high expense; but it is sad to think that by its introduction one more opportunity was lost for the efficient planning of many great cities.

Segregation of the various means of transportation according to the varying densities of inhabitants has been suggested. This, so to speak, is the counterpart to the previously mentioned principle of segregation according to speed. In central areas, with their highest densities of population, the means of transport would mainly consist of an underground railway or other systems capable of moving large numbers of passengers at a time. In the outer districts, with their lower densities, transport would be mainly based on buses and cars. Rail and road communications would thus complement each other. But while the suggestion might have the advantage of economy and reduce necessary improvements in the network of roads to a minimum, the individual car would not fit into the plan and it would, on the whole, invoke the most intricate problems of control and restriction.

In spite of all its shortcomings traffic by rail is, and probably will

remain, more efficient than any type of surface transport on roads. While in most cases existing networks of rail communications will have to be retained, with necessary improvements and modifications, it will be necessary to define their functions more closely. Above all unnecessary competition between railroads and road transport will have to stop; bus routes should serve areas which are a long distance from railroad stations rather than connect more or less the same points. Both services should complement each other to a larger extent than hitherto. As in many cities they are under the same management the obstacles should not be insurmountable.

In medium size and smaller towns mechanised transport on rails is usually out of question because of the low volume of traffic. In such towns bus services and tramways, or their successors the trolley buses, are entirely adequate and would serve up to 500,000 inhabitants. It may be added that tramways are possibly the cheapest forms of mechanised transport at about one-twentieth the cost of an underground railway.

Lastly, there is the traveller himself. At present an enormous amount of time is wasted in each big town by long journeys. In terms of money many thousands of pounds are lost every day. In terms of human values the losses are still greater. Long travelling by increasing the working hours forms part of the working day though it is not paid for. It reduces the time for recreation and leisure and consequently is a menace to health.

In medium size towns it is quite possible to reduce the journey between the dwelling and the place of work to fifteen or twenty minutes for one way and, it may be expected, a community of this size can offer varied occupation and shelter to all its members. On a previous page it has been maintained that the medium size town should be the basic unit for the large town. Here is one more reason for the adoption of that principle.

## CHAPTER III

### LAND SUBDIVISION

#### 1. GENERAL PRINCIPLES

**N**OW we have to deal with the principles and methods which apply to the subdivision of urban land. For this purpose we can assume there already exists a zoning plan and that the traffic specialist and road engineer have settled the various problems of the main road plan. The use of and the relation between the different areas have been determined. And so are the respective networks of the major and minor roads and their junctions and intersections. The problem is now to settle the layout of local roads serving the different purposes of residence, business and industry.

There are two main tasks: the design and layout of new urban areas and the redevelopment of existing areas. Both are equally important. Here we deal with the former. The latter is not only the larger but is also the far more intricate task. With that we deal on page 74.

The layout of industrial and business sites is governed by the requirements of factories and business premises as regards access, the placing of buildings and yards and similar special considerations. There are no general principles and rules. Industrial estates are usually laid out on spacious sites with a few access roads and a grouping of buildings in accordance with the process of production. This may be a straightforward one-way process like, for instance, the working process of a cotton mill. Or it may be a very complicated system with several parallel working processes. There may be a main process with others branching off. Thus there may exist a great variety of arrangements which each require special consideration.

In all cases ease of access and a convenient relation to rail and road communications or other means of transport, are essential. Where industrial sites are in the neighbourhood of residential areas buffer zones should be provided, preferably green strips, and it might be

a good plan to have the works canteens close to them so that workers could the better enjoy their lunch-time break.

With regard to the siting problems of business areas we have chiefly to consider office blocks and shopping centres. The former may be planned on sites facing minor roads, provided sufficient care is taken to have the entrances to buildings from secondary approaches so that the stream of office workers coming and leaving the buildings would not create a danger to traffic. Height-zoning for such buildings is absolutely essential. The proportion of open land to land covered by buildings must also be fixed lest the old evils of traffic congestion and bad working conditions crop up again. The higher the buildings the more space must be about them.

It is decidedly advantageous for office buildings to be high, e.g., up to about twelve stories. They would then cover relatively small areas and would, if the zoning restrictions were properly enforced, be surrounded by pleasant open spaces. There is no need to go in for the expensive and uneconomical sky-scraper type of office block which, under British conditions, is entirely unwarranted. Business areas should be laid out for the convenience of employees, while the open areas about them should be designed primarily for their recreation during the intervals between their working hours.

Provision must also be made for cars to approach the buildings and for parking in the vicinity. Here again the open layout would greatly facilitate this task. Thus an area can be visualised with high buildings spaced well apart with plenty of space about them for movement, recreation, and parking accessible from a minor artery of high-speed traffic.

The problem of shopping centres has been touched before with regard to existing towns. In new areas they should be in a central position, well protected from the stream of traffic. They might be laid out in the form of rows or squares, where the shoppers could congregate and pass from one showcase to another. Shopping centres might be linked up or combined with business areas. In that case access to shops and offices would have to be considered and it goes without stressing that these should be separated as far as possible. Where the size and number of shops would justify layout of a shopping centre as a square that shape should be adopted for it is far the most pleasing and convenient arrangement.

Shopping centres, preferably, should be accessible from local

roads only and the number of the means of access should be restricted. Arrangements for the parking of cars should be conveniently near the entrances so that the centre is entirely for the use of pedestrians. In shopping centres laid out in the form of squares this would especially be desirable.

There are single and multi-storied shopping centres and in the latter the problem of access to the upper floors must be solved. Projecting balconies and ramps have been suggested to serve this purpose; other solutions are equally feasible. Such centres would offer all the advantages of concentration to which there might be added restaurants and other places of refreshment. In multi-storied shopping centres these facilities might be made available above the main building with roof gardens and terraces. Nowadays it is held that local shopping centres should be related to populations of about 5,000 to 10,000, *e.g.*, to a size of residential area which is termed the neighbourhood unit.

It may, however, be asked whether this figure, though it offers a margin for variety, is not too small. That it would allow the local shopping centre to be established within a desirable distance of the residential areas is not disputed, but whether this limited number of customers would permit a sufficient variety of goods to be offered is another question. Further reference to this phase of the problem will be made in the last chapter.

We proceed to the subdivision of urban land for residential purposes. This concerns the size and shape of building blocks formed by residential roads; the further subdivisions to serve for access to houses and flats; type of buildings, their spacings and relations to open areas and other amenities. They all depend on the number of persons who are to live in these areas, *e.g.*, on the densities of population. By several methods we can determine densities. The first and most common is to relate them to the numbers of houses per acre. In regard to certain types of houses this method may be adequate; it is often misleading where there is great variety of building types and accommodation.

The second method of working out densities by numbers of persons per acre is more accurate, but it omits the relation between land and buildings. The most descriptive way is to use both methods in conjunction, and to work on the basis of so many residential buildings and so many persons per acre. By this means we have some clue as to the types of buildings used; for instance, a



56 PLANNING AND TRANSPORT: EFFECTS ON INDUSTRY AND RESIDENCE  
density of 130 persons and two buildings would clearly indicate flats.

The whole problem of densities is very complex. Density figures by themselves tell little. It is necessary to know the circumstances to which they apply. One may say twelve houses and about 40 persons to the acre are a satisfactory figure. But eighteen houses and about 60 persons per acre may, equally, be possible. If these twelve houses were bungalows and the eighteen houses normal two-storeyed structures, the former would cover substantially more land and might therefore be less desirable. Thus the calculation of densities might also be related to heights of buildings and coverage of ground.

Densities must also be related to means of transportation, though not in the previously mentioned sense.\* But it is essential that more densely populated areas with a higher potential of traffic should have a more efficient transport service than areas with low densities. Thus, for instance, areas with predominantly flatted development should have in large cities the advantages of rail transport and flats should be built in the immediate vicinity of underground stations in preference to houses.

A few density figures may now be added. According to the 1931 Census the average density in London was 58.7 persons per acre, varying from 17.7 persons in Woolwich to 151.7 persons per acre in Southwark, while in some wards there were densities of more than 200 persons to the acre. This last density would be obtainable with seven-storeyed blocks of flats spaced apart  $2\frac{1}{2}$  times their building height, e.g., 150 feet, and under these assumptions a satisfactory and in every way convenient layout would result. If the same density would refer to two-storeyed one-family terrace houses there would have to be more than 50 houses to the acre. These houses with an overall floor area of 720 sq. ft.—entirely inadequate—and a frontage of merely 12 feet could under these circumstances be spaced apart only 42 feet, which would designate them from the very beginning as slums.

This example at random may show how intricate and varied the problem of densities really is and how misleading mere figures can be. In cases of mixed development—houses and flats—which is commendable for many reasons, high density figures should not be taken on their face value and condemned. The L.C.C. plan has

---

\* P. 42.

found critics of its three density zones of 200, 136 and 100 persons to the acre which, as it was contended, would force the majority of the population to live in flats. In point of fact however, there is, with the exception of a relatively small inner zone considerable variety of accommodation provided in this plan.

In the reconstruction plan for London prepared by the London Regional Reconstruction Committee<sup>a</sup> a more evenly spread distribution of population over the region is envisaged, and consequently there is greater variety of densities. In fact five different densities are suggested starting with a maximum of 160 for the central area, which is reduced to 110, 70, 45, 20 as maximum densities for the consecutive zones.

Lastly there may be mentioned some figures for densities in residential areas as recommended recently by the Ministries of Health and Works in their joint publication, *Housing Manual*, 1944. These figures are for general guidance only and reflect the trend rather than the rigidity of formulæ. The following five densities are suggested and might be compared with those of the London Regional Reconstruction Committee:

Open development, 30-40 persons (e.g., houses, various types).

Outer ring of a town, 50-60 persons ( " " " ).

Inner ring of a town, 75 persons (e.g., predominantly semi-detached houses and terraces, some flats).

Central areas, 100 persons (terraces and flats).

Central areas in large towns, 120 persons (flats and terraces).

With regard to densities of houses to the acre it seems as if the so-called twelve-to-the-acre formula, so generally adhered to in the years between the two wars, has become much too inelastic, a principle for the tasks of rehousing after this war. In general it may be contended that in the case of detached houses a maximum of twelve houses to the acre should not be exceeded, while eight houses or about 30 persons to the acre would be a more desirable figure.

Semi-detached houses can be planned in densities up to fourteen or sixteen houses or 50 to 60 persons to the acre. With terraces far greater densities are possible. While eighteen houses or about 65 persons to the acre represent a very desirable condition, twenty and even more houses are still satisfactory. In one of the schemes the present writer prepared<sup>b</sup> a density of 30 terrace houses per acre,

<sup>a</sup> Greater London: *Towards a Master Plan*, p. 39.

<sup>b</sup> *Thirty to the Acre*, Walter Segal. *Building*, April, 1944. P. 98.

or a population of 110 persons was assumed, and yet it was possible to space the rows 70 feet apart in front and 96 feet in the rear. The houses, of necessity of the narrow-fronted type, had one living room of 196 sq. ft. and two bedrooms of 165 and 125 sq. ft. respectively, in addition to dining kitchen, separate bath room and w.c. and other ancillaries.

In flatted areas densities up to 250 and even 300 persons per acre may be envisaged and here the fifty-to-the-acre formula seems to be unnecessarily rigid. Generally, with blocks of flats densities may be increased by building high and some theorists have suggested this measure over and over again. In U.S.A. skyscraper blocks of flats are quite common, but considerations of cost and convenience weigh heavily against such buildings and it would appear that for domestic purposes the seven-eight storeyed block represents an optimum.

Next we consider the site plan, its properties, grid of interior streets building blocks, aspect and orientation. First to be considered is the suitability of building land in relation to its properties. It is clear that flat land presents the least difficulty for a good, sound and economical residential layout. Wherever possible such sites should be given preference. Sloping and hilly land in residential districts is best made use of for open areas and parks. Their disadvantages for building purposes may successfully be exploited to obtain a varied and pleasing layout of green areas. Change of level coupled with carefully considered planting makes for splendid parks. Footpaths can be provided with little cost.

However, there are cases when sloping sites must be used for housing schemes. These increase both difficulties and cost. Nobody should suppose that what some are pleased to call the variety and interest of such layouts are not heavily paid for. In point of fact the interest of a layout should be sought elsewhere : in the harmonious grouping of well-designed and related buildings and in the effective arrangement of gardens and surroundings. Only the bad planner needs changing levels to be inspired. Where, nevertheless, the unavoidable happens and a sloping site cannot be ruled out the planner is faced with the alternative of following the contour lines when laying out interior streets or secondary approaches. Where gradients are not too steep it might be possible to run the greater number of interior streets uphill.

From a road builder's point of view this is certainly the cheaper

method but it seriously complicates the construction of the houses which might require substantial understructures and would, consequently, become rather more costly. Where the alignment of interior roads, on the other hand, follows the contour lines of the site greater convenience for house building is secured, but the costs of street building are increased because of the retaining structures which have to be provided.

Such roads would, more or less, constitute a system of concentric ring roads connected by several roads running uphill. Normally they would be lined by houses on either side. Houses on a higher level than the streets would be advantageously placed for access and interior planning; their opposites, however, with their ground floor levels below street level would suffer drawbacks of which inconvenience in access would be the least awkward.

This latter difficulty was already stressed in that astonishing document, the Tudor Walters Report of nearly thirty years ago (1918). The remedy there prescribed was the single row pattern. This would apply especially to sites on steep slopes with gradients approaching one in six. On the whole, such layouts are by no means economical and had better be avoided. With sites on sloping ground there are disadvantages and high cost either for the building of houses or the making of roads. Which alternative offers the better way out is a question that can only be decided from case to case, much depending upon the gradients of the slopes.

Some general classification of interior or residential roads is now required. These bound the building blocks with which we shall deal later and may be subdivided into major and minor interior roads. The function of major roads is chiefly the distribution of interior traffic; though, in many instances, they also have to serve for access to sites. The function of minor roads is merely to give access.

Major interior roads will normally possess a carriageway with two traffic lanes and where required two parallel strips for standing vehicles. The minimum width of a traffic lane is about 8 feet: 10 feet is a good average. For parking strips a width of about 6 to 8 feet is required with 7 feet as an average. Thus a normal width, all included, of about 35 feet between kerbs would result which might under given circumstances be increased to about 40 feet. Minor interior roads might vary in width between 16 and 18 feet for carriageway and no extra allowance for standing vehicles need normally be made.

The problem of standing vehicles is not free from controversy. While there should be separate parking places well separated from major and minor arterial roads as well as from local roads serving business and industry, the problem of parking in purely residential roads is somewhat different. There is the visitor, the delivery car and the refuse removal van. All these would have some business in the street which would oblige them to leave their vehicles for some time in front or near the house. For these a separate parking space off the residential road would either be unnecessary or inconvenient unless the road was too narrow to allow other vehicles to move past. It is here that the parking bay may be in its right, especially if the width of carriageway is cut down to a minimum.

Minor and major residential roads should have footways on either side of which the width might vary between 6 and 8 feet. Grass verges might be added. Widths between building lines, if houses and other buildings were to front such streets, should be not less than 70 to 80 feet in the case of two-storeyed buildings. That is about the minimum width required to counteract an impression of cramping.

The spacing of houses in rows, or otherwise, and of blocks of flats is very largely a question of orientation. Satisfactory relations between heights of buildings and spaces between them must be ensured to allow for a sufficient measure of sunlight for the dwellings. There are no hard and fast rules as to which orientation is the best but it is usually contended that about two hours of sunlight should be possible for each dwelling on the 21st of December, winter solstice.

Houses might face East and West or North and South. In the former case it is usually attempted to have the bedrooms facing the morning and the living rooms the afternoon sun. With this kind of orientation the relation of heights to spacing of buildings should be 1:2, or 2:7, which latter would ensure  $2\frac{1}{2}$  hours of sunlight on the 21st of December. Where dwellings are planned to face North and South care must be taken to have no living and bedrooms on the North side. If this can be achieved the results are satisfactory, especially in spring, autumn and winter. During these seasons houses with a southern aspect are superior to others with an East and West aspect and it is a well-known fact that the former are much warmer in winter. In summer, however, the house with East and West aspect has the sun's greater warmth, which is sometimes an advantage and occasionally a nuisance.

As regards spacing, rows with North and South aspect are less economical since the relation between height and spacing of buildings in this case must be 1 : 3, or 3.5, to give satisfactory results by permitting the use of the winter sun. In winter the sun is at a low altitude. Its rays in the North-South direction then cast long shadows and, therefore, a wider spacing is required. Into the house with East and West aspect the sun's rays enter the rows at an oblique angle and consequently cast shorter shadows.

Both types of orientation should be used and might be happily combined in the square, that is the square with buildings on three sides only. Never should there be a fourth side to a square since, in that case, the living and bed rooms of the dwellings would either not face the square or would have to face North—an entirely undesirable proposition.

The residential layout pattern should be varied. Variety, however, does not directly depend on an interesting grid of roads. Variety results from a happy grouping of buildings, and pleasant relations between the various types of buildings and other elements of the layout. Above all there is no reason why the lines of buildings must always slavishly follow delineation of the roads. It is the stereotype "lining" of roads with houses which has produced those absurd and uneconomical road patterns for "interest's sake."

The road layout has strictly functional purposes. The grouping of houses is conditioned by many other considerations and one is the creation of architectural values. Where these cannot be made to harmonise they should be frankly dissociated for the benefit of the layout. It is time to break away from the bad habit of bending and twisting the road pattern to make it serve purposes of an entirely alien nature.

The road layout must be as economical as possible. Unnecessary lengths must be avoided to keep development cost at a minimum. Well dimensioned roads with sufficient space for movement are preferable to interesting shapes. This does not tie down the layout pattern to the gridiron. There is the straight road and the curve. The latter may supplement the former and there are cases when it provides the better solution. There are cases when unorthodox road plans achieve considerable savings in cost.

Generally, however, at the risk of being repetitive, free interpretation of the gridiron offers the best method of approach. This will help in seizing the intricacies of the problem and to form a general conception of the grid of interior roads. It may be modified,

amended and changed at various stages of the design to suit the particular properties of the site. The houses and other buildings may then be freely related to the road plan and access be provided by means of secondary approaches.

Next is the problem of the building block, its size, dimensions and proportions. Such blocks, normally, are bounded by major and minor residential roads. In the past building blocks were rather small. The typical block was a shallow rectangular affair of just two plot depths, bound by four residential roads of the same merit and usually laid out with two opposite rows of buildings. This of course was a highly uneconomical form of subdivision with heavy road charges and little convenience. Frontages had to be anxiously watched and floor plans of houses were therefore defective in many senses. The suburban developer used this form of block frequently for rows of semi-detached houses with narrow frontages and those narrow, dank, dark and draughty side passages which form the "gaps" in the familiar street architecture of such layouts.

From a traffic point of view the small and shallow building block is hardly less undesirable because of its many intersections which are obstacles, even for slow-speed traffic. The obvious way to overcome these defects is the large block. This has been consistently advocated for a number of years and various attempts have been made to determine optimum sizes and shapes.

Mr. Barry Parker<sup>7</sup> has experimented with hexagonal blocks in the attempt to reduce the lengths of bounding roads. It is obvious that with polygonal shapes of blocks the relation of circumference to contents is better than with square or rectangular shapes, and that improvements are effected when the polygon approaches the circle. While there would thus be a considerable saving in cost of development there would, as Mr. Thomas Adams<sup>8</sup> has pointed out, be created a great number of badly shaped plots and a certain awkwardness as regards communications.

Other types of blocks have been suggested. The two most obvious are the square and the rectangle, both of which need not be interpreted in a narrow geometrical sense. Blocks of this kind in lengths up to 1,000 feet and more have been considered and though the square block is more economical than the rectangular

<sup>7</sup> *Economy in Estate Development*; Barry, Parker. *Journal of the Town Planning Institute*, June, 1928. P. 186.

<sup>8</sup> Adams (1924) p. 212.

block as regards the relation of circumferences to areas, the latter has greater advantages for internal subdivision and orientation. Both types would, because of their large dimensions, admit the provision of internal green spaces of a common character for the use of all adjoining residents; and these might in the case of the square block be squarish, or informally round of shape, whereas with rectangular blocks the green spaces might run parallel or at right angles with the long sides of the block.

Here, then, is the counterpart to Mr. Alker Tripp's precinct planning, for these large building blocks would be closed for through-traffic and be accessible only from a network of secondary approaches. There is, however, one difference. In residential precincts because traffic considerations play a less important part it is chiefly the economy of layout and the matter of convenience which are to be served.

These conceptions date back to the years before the war. Especially in U.S.A. a number of studies were made on the subject. There is no conclusive evidence on any of the large block types standing out with regard to size; nor can it be expected there will be any definite answer to this problem where so much depends on individual circumstances.

## 2. SUBDIVISION OF BUILDING BLOCKS

We now proceed to methods of interior subdivision. For the opening up of large building blocks there are several methods which should be utilised in accordance with the size and dimensions of the blocks. Such are the multiple "building lines," the various secondary access roads and—in the case of terrace housing—the use of the row at right angles to the street, and eventually the square.

Multiple building lines which have been developed largely in the U.S.A. are advantageous in regard to detached and semi-detached houses with access from a minor residential road. If houses fronting such a road were laid out in a single row or "building line" the old problem of street and utility cost would enforce close spacing and narrow frontages. To avoid both, two or three such "building lines" might be arranged, one behind the other with secondary access from the road either by footpaths or drives.

The "double building line" type of development would thus consist of two rows of plots, one behind the other and both running



parallel with the street. In the case of a layout of semi-detached houses two plots of the row in the rear would, at a time, be reached by a common drive between two plots in front. The drive need not be wider than 8 to 9 feet and there should be a small turning space at the top which would give access to houses in the rear. Thus there would ensue a staggered arrangement of houses—particularly suitable for pairs of houses—which would help to break up the monotonous lining of a street of such houses. Furthermore the houses in the rear, owing to this staggered layout, would not be cut off from sight and—the greatest advantage—the frontages of the plots in front and rear might be considerably increased. This increase of frontage might amount to a quarter or even one-third of the original frontage of a single building line; and in spite of this increase of the individual frontages the total length of required road frontage could be decreased by about 30 per cent.

The "triple building line" with three rows of houses is not quite so advantageous as the "double building line," but with pairs of houses and the same density as in the above example, *e.g.*, twelve houses to the acre, there would still be a handsome saving of road frontage, about 20 per cent. In this case three pairs of houses might be grouped round a turning space with access to the different plots. Some pleasant arrangement of this pattern can be imagined.

Next we come to the secondary access roads. First of all is the through-access road, arranged between two minor residential roads with plots on either side. Equally suitable for all types of dwellings, including flats, it would consist of a carriageway of light construction of about 12 to 16 feet width, according to requirements regarding footpaths on either side. Using again the example of semi-detached houses and a density of twelve houses to the acre, a similar extent of frontages of minor residential roads would be required as in the case of the "second building line."

The through-access or cross-access road is in fact one of the most adaptable and practical of secondary access roads. It allows for a satisfactory grouping and spacing of houses and ensures a simple subdivision of blocks with well-sized plots resulting. There is no difficulty to ensure good and equal orientation of houses and, again, wide frontages become possible. A certain drawback, however, is the danger of through-traffic and special care must be taken with this type of access road to make its use as unattractive as possible to the motorist who looks for a short-cut. This can be achieved by suitable bends of the road at the entrances and exits, as well as by

the grouping of houses to such effect as to disclose the nature of the road to a stranger and complicate the drive through for the habitué.

There is, further, the well-known cul-de-sac pattern, so widely used that a few remarks may suffice. This is a layout form which offers wide possibilities of variation and which has, in addition, the advantage of being economical with regard to the required lengths of minor residential roads. In the above-mentioned case of semi-detached houses with a density of twelve to the acre, less than half the length of residential road would be required for a cul-de-sac layout than for the single building line. On the other hand the access road to the cul-de-sac should not be less than 16 feet wide and a spacious turnabout of not less than 50 feet between kerbs (in U.S.A. 60 feet between kerbs) would be required at its end. This in fact reduces the saving of road frontage to some extent. There is also the problem of maintenance of the access road. Public authorities often in the past objected to such duties. Another drawback is the feeling of isolation so easily conditioned by a cul-de-sac layout. To widen the layout at the upper end has been suggested and, perhaps, combine it with some kind of quadrangle. There are numerous instances where this arrangement can be studied in actual practice.

To counteract this closed-in feeling the cul-de-sac might have footpath connection with other secondary approaches or with streets beyond it; but that would not alleviate the true nature of the problem. The only remedy is to make the cul-de-sac as spacious as possible, in particular at its entrance. This would bring it near to a pattern which is called the quadrangle and which, in fact, may be described as a widened cul-de-sac.

Lastly there is the "loop." In many ways similar to the cross-access road there is the difference that its entrance and exit are from the same residential street and that it therefore encourages through traffic much less than the former. On the other hand this is a pattern which does not greatly encourage a good layout of houses, especially in the portion circumscribed by the "loop." There is an undesirable abundance of corner plots which for residential purposes are unsuitable because of poor privacy; there are difficulties of orientation of houses; and unless the centre portion is used for an open green—which would bring the pattern near to the quadrangle—the "loop" is not a really satisfactory type of secondary approach.

In actual practice all these various types of secondary access are

utilised in combination to suit the properties of building blocks and to achieve variety of layout. Thus, for instance, the "double building line" may conveniently be coupled with the cross-access road and similarly combinations between the single building line and the cross-access road may be envisaged. The frequently used combination between "single building line" and cul-de-sac is far less happy as it creates conditions too unbalanced. Values of the plots facing on to the street tend to be reduced for the greater convenience of plots on either side of the cul-de-sac.

With regard to space enclosures created by the houses themselves there are two basic forms from which a great number of variations may be derived: the row and the square. Of row patterns there are two generic types. First there is the usual arrangement with rows of houses or blocks of flats lining both sides of a residential street. If the streets run North to South the East elevation of one of these rows faces to the street, the other with its West elevation. If the floor plans of the flats are well-planned with regard to orientation the bedrooms in the first row would look on to the street and get all the noise, whereas the living rooms would have a view of the gardens. In the case of the opposite row with the same orientation the aspects of the rooms would be reversed; and with the bedrooms facing the quiet garden and the living rooms facing the street a better arrangement would exist. One-half of the flats in the street would thus be unsatisfactory and if their aspects were changed their orientation would suffer.

The other type of row layout which might be termed the "perfect orientation and aspect pattern" consists of rows at right angles to the street, with access from secondary approaches. Each access road would serve one row only and thus a series of parallel rows could be envisaged, each with the same aspect and orientation. This pattern, already suggested in the Tudor Walters Report, was widely employed in layout schemes especially on the Continent where it became a practice to make use of footpaths as means of access to the rows. As mentioned before\* this provision has serious drawbacks insofar as it excludes the car where it is wanted: for deliveries and refuse removal, for the moving of furniture, the transport of the sick, and many other purposes. Such rows should either have access from a cross-access road or from a carriageway of sufficient width with a turnabout at the end.

The provision of so many access roads tends to impair the

---

\* *Op. cit.*, P. 47.

economy of this layout and so recourse was often made to the double row pattern with its conflicting orientation and aspects. On the whole the row pattern, if not broken up by other patterns or at least by rows of different direction and orientation, can be deadly monotonous; and even if the rows are spaced apart to conform with minimum spacings and the requirements of orientation there is often a cramped feeling about them, particularly if the lengths of the rows exceed the width of their spacing by more than 2 to 2½ times.

The square on the other hand, that is the square with buildings on three sides only, has many advantages over the row pattern and should be much more frequently used, the more so since it is a native product of this country with a very great tradition. Much more spacious than the row pattern it offers much greater variety of orientation—of the right kind; it opens far better possibilities of architectural treatment. With two opposite rows of buildings facing East and West and one row between them facing North and South—South being the aspect of the square—there exists no more desirable layout of houses and flats alike. In regard to acreage the square pattern need in no way be less economical than the row pattern, except in the case of very high densities. The present writer has tried to analyse the conditions under which the square pattern can compete with the row pattern. This occurs in all instances where the relation between length and depth of block and width of spacing corresponds with or is determined by the formula:

$$\text{Length of Row} = 2 \times \text{Distance of Spacing} - 2 \times \text{Depth of Row.}$$

This would mean also that the square type of layout can be used wherever densities up to 200 persons per acre and more are envisaged. In the case of the highest density, flats, of course, would have to be provided.<sup>9</sup>

The introduction of the large building block and recourse to various means of its subdivision would be deprived of one of its foremost aims if economy were alone pursued. One of the principal goods of this conception is that it would allow the frontages of plots and buildings to increase. This is most important since it would allow for the planning of houses with wider fronts and better floor plans than hitherto. A wide front means more

---

<sup>9</sup> *Square Pattern versus Row Pattern*; Walter Segal. *Building*, February (1944). P. 36.

desirably shaped rooms, more light and better circulation. In terraces it permits the provision of better means of access to rear gardens than narrow, dark, and draughty covered passages between two houses which neither of the neighbours desires to sweep for the other's convenience.

In existing areas with small and shallow building blocks the wide front plot will have to be ruled out in nine cases out of ten. Precinct planning may offer a solution of traffic conditions but a substantial part of the existing grid of local residential roads will have to be used because they will be intact and confer all the advantages of full development. Thus the narrow-fronted house will survive, but it should not be given priority; and for central areas, such as in London, where many restricted sites will have to be re-developed, as regards the buildings proposed, one can applaud the intention of the L.C.C. to make good use of the flat as a preferable type of dwelling.

### 3. COST OF DEVELOPMENT

It is estimated that the cost of building has increased by 100 per cent since the outbreak of war. Whether this figure has come to stay and will have to be accepted, much as an increase of about 50 per cent had to be accepted after the last war, or whether it will and can be reduced is not the subject of analysis in these pages. The fact conveys that pre-war figures which might be quoted would be meaningless and, also, that figures which could be computed by adding to pre-war cost would not see us very much further.

The relation between the various costs of building and development may have remained somewhat more stable. Though with regard to cost of land, for instance, the proportions have been altered, pre-war cost presented in percentages of a grand total may still be of value for our purpose. We may start with the statement that in normal low cost and medium cost housing practice the expenses of development in new areas did not usually exceed about one-fifth of the total cost of house and plot. The ratio of land cost to the total cost of house and plot is subject to variation in accordance with particular circumstances. With medium cost houses it averages about 4 to 5 per cent of the total cost. In the case of low cost houses this percentage may drop to from 2 to 3 per cent of the entire cost.

The rest of the development expenses is composed of the street and utility cost; these again bear a fairly constant proportion to

the total cost of house and plot, generally between 10 and 15 per cent. The cost of the gas and electricity mains are not included in these figures as companies usually provide them free of charge. This relation between cost of the house and the cost of land and development allows for the maintenance of relatively low densities of population in building schemes of this kind. The type of building, houses or flats, must be decided in accordance with the land and development cost. It is an old principle that cheap houses must go to cheap land.

The cost of roads which forms part of the development cost is either included in the total cost of plot and house or the occupier is charged with the cost of half the road width for the length of his plot. These road charges depend on the type of road and other forms of access. Great differences prevail in the cost per square yard of different types according to the provisions for construction and widths of carriageway, footpaths, grass verges, planting, and so forth.

Thus, a normal 50 feet wide road with a carriageway about 18 to 22 feet in width, grass verges with planting about 7 to 10 feet wide and two footpaths of six feet width, is about nine times the cost of a nine feet wide access carriageway with grass verges of 10 feet on either side. That road costs about twice as much as a 13 feet wide carriageway, of similar construction as the carriageway of the road proper, with grass verges of about 6 feet width on either side. The cost of a 40 feet wide road with provisions similar to the 50 feet wide road may be about 15 to 20 per cent less than the cost of the latter.

In consequence, considerable costs for road building can be incurred, or savings be made, according to the type of road and the system of layout adopted. The rough figures given above show the economies which can be achieved in layout schemes where the residential roads of normal construction can be reduced, and where sites can be opened by means of secondary approaches. The use of well considered secondary approaches may sometimes result in a larger acreage of general road area than in orthodox schemes but it should be borne in mind that a large percentage of the area would be employed as cheaper secondary means of access and that, therefore, savings could be achieved.

The bearing of street and utility cost on the frontage of plots may now be considered. Assume the case of a medium cost house on a plot facing on to a normal 40 to 45 feet wide residential road,

70 PLANNING AND TRANSPORT : EFFECTS ON INDUSTRY AND RESIDENCE forming part of a general development scheme on the customary principle of the "single building line." Let us further assume that the total cost for house and plot would be £1,200, subdivided as follows:

Cost of house	...	...	...	£960, e.g., 80 per cent
Cost of street and utilities	...	...	...	£180, e.g., 15 per cent
Cost of land	...	...	...	£60, e.g., 5 per cent
Total cost of house and plot	...	...	...	£1,200 = 100

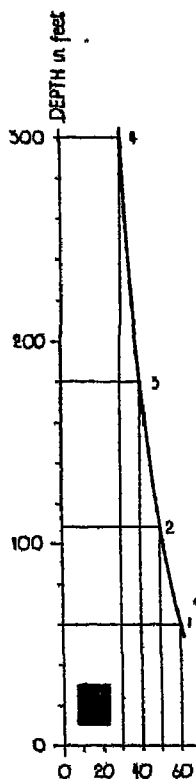


DIAGRAM SHOWING RELATION OF FRONTS AND DEPTHS OF PLOTS TO LAND AND DEVELOPMENT COST.

AREA OF PLOT	FRONT	DEPTH	COST OF PLOT	COST PER 50 FT	STREET AND UTILITY COST	COST PER LINEAL FT
1 3600 sq ft	60 ft	300 ft	£ 60	4d	£ 180	£ 3 0 0
2 5400	50	108	90	do	150	do
3 7200	40	180	120	do	120	do
4 9000	30	300	150	do	90	do

ASSUMED TOTAL COST OF HOUSE AND PLOT for ①

COST OF LAND	£ 60 0 0	5 %
COST OF STREET (45 ft wide) & UTILITIES	180 0 0	15 %
COST OF HOUSE	960 0 0	80 %
TOTAL COST	1200 0 0	100 %

FIGURE 8

We assume these round figures refer to a wide frontage plot with a street front of 60 feet, and a plot size of 3,600 sq. ft. This would mean a price of 4d. per sq. ft. of land and of £3 per lineal foot of street and utility cost. We can now see what would happen if the frontage of the plot were reduced to 50, 40, and 30 feet respectively, while its depth is increased. By spending the same amount of money on the house and an equal amount as before on street and

utility cost—in varying proportion—with reduced frontages, the prospective purchaser could have choice between four different plot sizes of 3,600, 5,400, 7,200 and 9,000 sq. ft. respectively. (See Fig. 8.) Reduction in the frontage of a plot means substantial increase in plot area for the same cost when compared with wide frontage and a shallow plot.

The lesson is obvious. With oppressive road and utility costs economy of layout and satisfactory frontages are difficult to obtain; cheaper types of access and layout must be employed to overcome these problems. In an analysis which the late Mr. Thomas Adams<sup>10</sup> carried out in 1934, comparing the cost of various forms of access to individual plots, he came to the conclusion that the "single building line," or the usual row pattern lining the sides of normal residential roads, is by far the most uneconomical of all types. As it enforces narrow frontages this pattern of layout might, wherever possible, be replaced by more efficient forms of access, allowing for more spacious, wide-fronted houses on well-shaped plots.

In the same analysis Mr. Adams contends, with regard to the various types of layout, that in the use of secondary approaches as means of access there is no great difference in street and utility cost between double and triple building lines, the cul-de-sac, the cross-access road and the "loop." The most economical patterns are the double building line and the cross-access road. The costs of development balance more evenly for the cul-de-sac, the triple building line and the "loop."

It can be assumed that with the use of large building blocks and secondary approaches plot and housing frontages might, according to circumstances, be increased by one-quarter or even one-third as compared with the frontages of the small building block bounded by four roads. The writer has made a comparison of two layouts for 96 houses each with equal areas of plots and different means of access. In the first case the usual rectangular block with four bounding roads of equal merit was assumed, yielding plots with 18 feet frontages and about 105 feet depths. In the second case a development of site with three cross-access roads running between two residential roads as before was considered; the frontages in this case could be increased to 27 feet with depths of about 70 feet. This would have permitted a far more convenient layout and floor plan

---

<sup>10</sup> *Design of Residential Areas*. T. Adams (1936). P. 190.



72 PLANNING AND TRANSPORT : EFFECTS ON INDUSTRY AND RESIDENCE  
of house than the former example. On the other hand if frontages less in width had been chosen a considerable reduction of development cost could have been obtained.<sup>11</sup>

These are merely rough figures intended to indicate the possibilities of planning large building blocks and secondary approaches with regard to building frontages and development cost. It is obvious that the depth of blocks has a considerable bearing on the economy of layout and the widths of frontages that may be achieved. In the degree that residential, distributive and major roads can be spaced apart the more advantageous will be the use of secondary approaches. Blocks may be opened up by cul-de-sacs on two or three sides, as was done by the designers of Radburn; but the cul-de-sac is limited in length by economy and by convenience. Normally such access roads are not economical if less than 200 feet long; a greater length than 300 feet, however, would offset convenience and add to the "backwater" features of the layout.

To increase the depth of the block a central green zone may be added as again was done at Radburn. But on the whole the cul-de-sac is a pattern that should be used in conjunction with other secondary access roads. If used alone it should not dominate the entire layout. The cross-access road permits the spacing of residential roads 500 feet and more apart. With central common green strips, not less than 60 feet in width, running parallel with the residential roads ease of access can be combined with safety and privacy.

A comparison of the single building line and through-access road with special reference to frontages and development cost may be added (see Fig. 9). The first figure shows a layout of 18 houses fronting a 42 feet wide residential road with plots of 20 x 160 feet and a density of twelve houses and about 43 persons to the acre. Street and utility cost have been assumed with £3 per lineal foot of frontage (the figure might now be considerably higher). The resulting total cost of development would amount to £1,080, or £60 per house. This is compared with a layout for an equal number of houses on either side of a through-access road connecting two residential roads spaced 540 feet apart. The density and acreage are the same and so are the development costs. But the

---

<sup>11</sup> *Housing Frontages*: Walter Segal. *Architectural Design and Construction*, October (1943). P. 202.

frontage of the individual plots in this case is augmented by one-third, *e.g.*, 30 feet.

As can be seen the wide front plot need not be less economical than the plot with a narrow frontage but it requires a different

# COMPARISON OF FRONTAGES FOR LAYOUTS OF EQUAL ACREAGE SINGLE BUILDING LINE

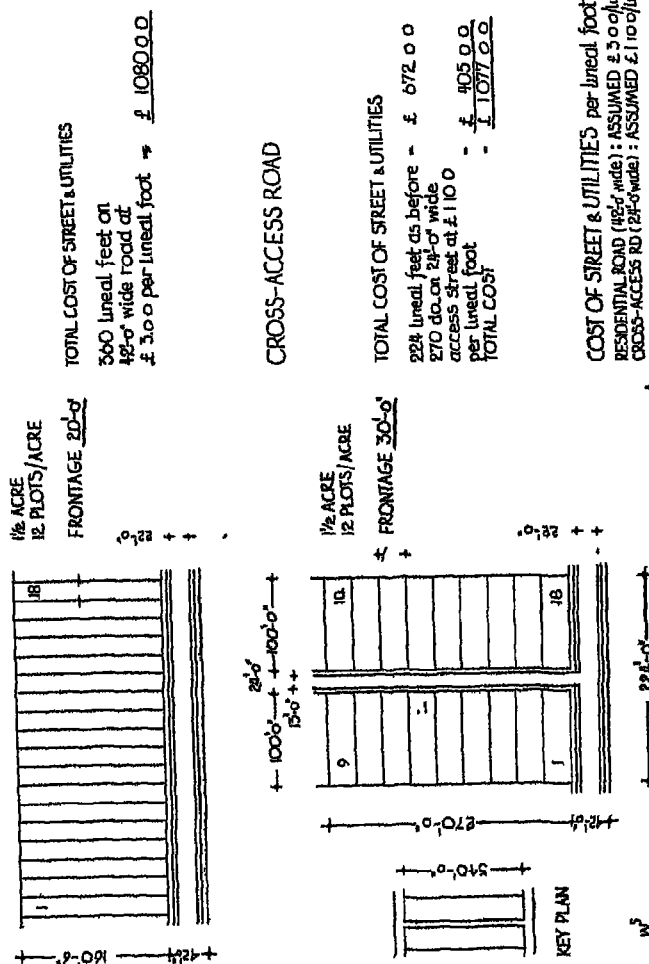


FIGURE 9

layout. If the former course were adopted houses with only 20 feet front would have to be arranged in terraces, and, moreover, the narrow frontage would not permit any but a poor access to the rear garden, *e.g.*, a covered passageway between two houses. In the

latter case, however, semi-detached, or even detached, houses might be built. If terraces were preferred they might be of the pleasant wide-front type which permits a variety of highly satisfactory floor plans and also affords good access to the rear garden.

A frontage of 30 feet is indeed economical if aimed at from the beginning and the layout considered accordingly. Where, however, there is no co-operation between land sub-divider and house planner the narrow frontage carries the day and the chance to build a better house is gone.

In a study which Mr. Thomas Adams<sup>12</sup> published in 1931, five housing schemes for lower and medium incomes were analysed. The data of house and development costs were given; it appears that the proportion of street and utility cost to the total cost of house and plot was fairly constant, amounting, on the average, to about 13.6 per cent of the whole. Furthermore, it was found that the cost of development did not greatly vary with the width of frontage.

#### 4. EXISTING URBAN AREAS

The problems of the re-development of existing urban areas are, perhaps, the most formidable and pressing tasks of reconstruction. With one in three houses damaged in Britain, many beyond repair, this is tantamount to re-planning and re-building on a gigantic scale. Old cities must be set in order before new areas can be permanently developed and the terrific housing shortage will, in the shape of temporary dwellings, neutralise a large area of building land for a considerable space of time.

With such a task a long-term policy for re-building is inevitable, and after so much has been lost by destruction it is only common sense that the best possible use shall be made of what is left. In towns this applies to houses and the networks of communications alike. Of about four and a half million houses of an age between 80 and 250 years many have come down and many more will be unfit for use; others will have to be given yet another lease of life as best may be.

New permanent houses must be built as soon and as cheaply as possible and—fortunately—more is expected of them than of their predecessors. A very great number of houses and flats will go to

<sup>12</sup> *Neighbourhoods of Small Houses*: R. Whitten and T. Adams (1931). P. 132.

existing areas, devastated areas that have been cleared and are waiting for new dwellings. There are many such areas in England, already fully developed with good roads and services available.

These roads and services must be used where possible though they no longer conform with modern layout practice. Some will not fit into the programme and will be abandoned. There are others which need only to be re-defined. Precinct planning may render them capable of further service. The grid of residential and other local roads is there. How can it be used to the best advantage?

This, more particularly, is a question of houses and flats and concerns the types of buildings which are to be erected on these roads. In the central residential areas of towns large building blocks are practically non-existing. They can be created by precinct planning, but they need not be opened up by secondary approaches. The subdivision already exists where there are small and shallow blocks. These in most cases will exclude planning with wide frontages.

Consequently there are two ways of planning. One is on the lines of the narrow-front terrace house; the other is the flat. It is not intended to contribute to the house versus flat controversy. While the flat is still capable of further development both types have advantages and disadvantages. The house is, perhaps, more suitable for families with children; the flat suits the young couple, the childless, and the bachelor. Both types in fact are inter-related and conform to varying requirements at different stages in the lives of individuals and families. A mixed development of houses and flats is desirable in most urban areas to allow for variety in accommodation. Flat buildings permit higher densities than houses and this fact, coupled with mixed development, would make it possible to construct houses in urban areas from which they normally would be debarred. To fix varying ratios between houses and flats in mixed development in accordance with the densities of respective areas is essential. Thus one type of dwelling would act in support of the other as envisaged in the County of London Plan.

Mixed development is the right method of planning the precincts in central residential areas of towns. As regards the frontages of new terrace houses built in such districts they will probably have to conform with plot widths of about 20 to 23 feet, or even less. It is to be hoped that the floor plans to be developed will avoid dismal and extensive outbuildings which, jutting out in the rear, disfigure

terrace and garden alike. The shorter the front the less need should there be for any projections or features which, though well-suited to the wide-front suburban terrace house, deprive the town house proper of its urban character.

This urban character of terraces is a factor which it is essential to ensure in mixed development; otherwise contrasts may be too strong. A two-storeyed terrace house is required which can take up and continue the tradition of the past; dignified in appearance though not as high as the old terrace house of bygone days; planned for modern requirements with storage facilities indoors; and without the garden shed.

As regards the planning of flats there is yet much scope for development. New and better types will—it is to be hoped—come forth and help to destroy an old prejudice. The relation of houses and flats in mixed development must be carefully considered so that flat buildings will not impair the privacy of houses in the same area, nor rob them of sunlight or space.

From a cost point of view it seems that the individual flat is still inferior to the small house. Mr. H. J. Venning,<sup>13</sup> has recently compared the cost of fifty working-class flats with that of fifty cottages. The flats built by a college housing society in London are of the separate staircase type, four storeys high with concrete floors and have no lifts; the cottages conform to normal small house standards. In both types of dwelling accommodation was the same. Twelve houses and fifty flats respectively were erected to the acre. Omitting the cost of land the fifty flats cost £33,000, e.g., £660 per flat; the cost of fifty houses (including roads and sewers) was £23,000, or £470 per house.

It is possible that other instances may be more favourable to the small house since in Mr. Venning's example, the flats do not conform with present requirements as regards access. Where there are more than three storeys lift service is now desired. But in the inner residential areas of towns, where space is precious and land is dear, densities of population achieved by providing houses are insufficient. We cannot afford to live without concentration, without big towns. They are expensive but their costs are paid in other currency besides money. A great nation cannot exist without great cities.

<sup>13</sup> *Houses and Flats: A Comparison in Costs*; H. J. Venning. *Architect and Building News*, January 14 (1944). P. 32.

## CHAPTER IV

### OPEN SPACES

#### 1. DENSITIES OF POPULATION AND OPEN AREAS

**I**N many towns the destruction of the war has opened new prospects for the adequate provision of open spaces for recreation, health and sports. Sites have been cleared of buildings which may add to the acreage of open areas already available and be worked into a general scheme of development. More open land will be available and a better distribution of open spaces in towns can now be undertaken.

Certain aspects of the problems which arise in connection with open areas, continuous or intermittent, have been discussed already and figures may now be added showing the extent of open areas to densities of population. It is generally held that about seven acres of open space should be provided for every 1,000 inhabitants and that the open areas should be subdivided to suit local requirements and habits. The following subdivision is suggested as a general basis, to be modified in accordance with the merits of each particular case :

- (a) Playing fields (all kinds), recreation and sports centres and allied activities ... 3 to 3½ acres
- (b) Parks (all types), open spaces in industrial areas, including buffer zones and allotments ... 2 to 2½ „
- (c) Small open areas for various purposes in the immediate neighbourhood of dwellings ... 1 to 1½ „

In the distribution of open spaces care must be given to the residential areas in the inner town, usually much more densely populated than areas in the outer districts, which have least open spaces. Where such areas continue to be used for residence sufficient reservation for open land should be made in their vicinity, *e.g.*, in walking distances of not more than 15 minutes. If this aim cannot be served by large coherent green zones, such as

green wedges stretching deep into the central areas of the town, recourse must then be had to the small intermittent green space, the small park and the public open ground.

Small areas are now available in great number and if utilised as they should be, additional open space could be provided economically for urban areas which need it most. Where this expedient is not possible and the ground must be used to full capacity, as much space as possible should be saved by building high.

In certain towns it might be feasible to augment large existing open spaces by adding neighbouring sites which have been cleared of buildings, or make even bolder steps towards the establishment of green belts and wedges. Provision for both, and in particular for green belts, has for a long time been an essential of zoning and many towns have planned for a green belt to encircle the outskirts. These arrangements involve travel and while they are extremely useful on Sundays and holidays there remains the problem for days of the week when recreation is even more necessary and must be compressed into few hours.

In some areas, where large open grounds are unobtainable, it might be possible to work the small intermittent green spaces into a system of green areas, together with open spaces about blocks of flats. In housing layouts similar attempts might be made by linking central common greens of building blocks with small public open spaces. These, however, should be considered as measures for emergency rather than for general practice.

Normally it will be difficult to relate, equally well, the two types of open spaces under (a) and (b) to residential areas, for each will be required to serve different age groups of the population. Where that adaptation is impossible the needs of the older generation should come first, e.g., parks, etc. Playgrounds, with the exception of playgrounds for schools, may be provided at whatever distance that can be done. School playgrounds as well as the buildings, obviously, form part of the residential area which they serve and must not be separated from it. On the other hand, in the separation of dwellings from industries, the provision of green strips as buffer zones should be made a *sine qua non*; exceptions should be permitted only where an equivalent can be provided.

## 2. SITING AND LAYOUT

Several patterns have been suggested for the layout of large open spaces. There is first of all the familiar green belt and the somewhat younger wedge. The latter, perhaps, is easier to apply as in existing cities it would not conflict with the need for major radial arteries and, in addition, it confers the advantage of better connections between town areas and open country than does the green belt. The combination of wedge and belt, nowadays so frequently advocated, corresponds with the circular and radial layout pattern of the main arteries.

In actual practice this system of combined wedge and belt will have to rely more on the former than the latter. The wedges might be taken deep into the town but the belt will consist of a chain of large and smaller green zones and parks rather than as a continuous open zone of stated width. It is more important that the wedge should be coherent than the belt. Town dwellers would then be enabled to reach open country by the green ways, stretching from the centre of the town to the perimeter, without close contact with buildings. The park lands of the green belt would mainly be developed as open spaces with special functions.

It is generally essential to assign definite tasks to different types of green areas. That there should be more facilities for varied outdoor recreation is now commonly agreed. Large towns offer alternative means of recreation and amusement and not all of them promote public health. Especially in the inner residential areas recreation is chiefly an in-door affair. The Sunday walk has fewer attractions for many people than the Sunday visit to the picture house and other places of indoor entertainment. Also, with the difference in classes and age groups there are differing requirements to be considered. Those who take a Sunday afternoon stroll through the park and settle finally in a deck chair, like others who spend hours on a golf course are often past the time when a football match, or a game of cricket, was the recreation most preferred.

Open areas have an educational side and on that ground also town dwellers must be encouraged to seek health and relaxation in the open air. This is partly a matter of providing facilities in convenient distance from the dwellings, partly it depends on attractions which the open areas offer. Recreation for many people means active entertainment and not rest, and the sports and games



fill only part of the bill. The open air theatre has been a great success. Many other ways of providing entertainment in open areas should be developed.

While this might be done chiefly in the parklands of the green belt, the wedges would be eminently suitable as walking ground leading out of the town into the country, or to places of entertainment in the green belt itself. In large towns, therefore, these wedges should offer the convenience of high-speed surface traffic. They might be planned in walking distance of a radial artery so that means of quick return would be available. Thus green belt and green wedge would complement each other by taking over different functions.

In large cities the provision of an outer green belt will not be sufficient. There should be an inner belt to pick up the termini of the wedges. This inner belt might rely on a system of existing open spaces in the inner town, with the necessary addition of new areas to form a chain. There are, however, cases when the formation of a green belt may not be feasible; there the system of urban open spaces will have to be based mainly on green wedges and a few large parks in the town. Under these circumstances it would be a good plan to arrange for the wedges to lead to the parks, which might thus be treated as part of a green belt. A system of wedges with park adjuncts would result which, though lacking the continuity of a proper green belt, might not be less useful.

Next to these large open spaces are the small green areas which serve the purpose of decentralisation and should be so distributed over the town that all urban areas would benefit equally. According to the space standards set out on page 77 there should be provision of 1 to 1½ acres of open areas in this category for every 1,000 inhabitants. In a district with a density of 100 persons to the acre there would thus be one acre of open land for every ten acres of housing area. This might be a small park, of say 180 by 240 feet. Allowing about 130 sq. ft. per person it could accommodate one-third of the residents at a time, e.g., 300 to 350 persons. If the park were planned as a central green space, within a large building block having a total area of 11 acres, and the same density ruled as before, no resident would have to walk more than 100 to 150 yards to reach it.

Parks of this kind would have a relatively private character and might be used for various purposes such as tennis-courts and

children's playgrounds; or, they could be laid out as gardens with suitable planting. Alternatively, several small parks might be combined to form a larger open area and while, with increase of size, greater variety in use would be possible, distances between the dwellings and the green space would be greater. In principle open spaces of this type should not be much more than 3 to 5 minutes' walking distance from the remotest parts of the housing areas to which they are related. Otherwise they cannot be expected to serve their purpose by attracting local residents who enjoy being in the open, but shun the effort of lengthy walks. Badly distributed small green areas for everyday use have only a nominal value, especially where they are bounded by roads. In existing cities, in the middle of the traffic, there are small open areas with flower beds, patches of lawn, trees and seats, and though they afford relief for the eye their practical value is very small indeed.

A sound planning policy for open spaces depends on differentiation. While the green belt and the wedges would be for the use of all, the small intermittent parks should be semi-private and laid out for the convenience of the adjoining residents. From a circulation and traffic point of view such parks are best in the centre of building blocks, where they offer the shortest access from all sides. They must be publicly maintained. Where the parks cannot be sited centrally and have to front on streets they should be bounded only on one side by a residential road. On the other sides access should be by secondary approaches.

Open spaces about the buildings themselves are to be considered. These must be treated separately from other open areas as, belonging to the housing areas proper, they are included in the density figures for the latter. The most private of all open spaces their sizes and proportions are largely determined by the layout and spacing of the houses and blocks of flats.

With the houses there are the usual front and back gardens, and whereas the former actually are part of the access road however well they might be fenced, a back garden is or should be the private open space of each family. Nowadays it is frequently advocated that the front gardens should not be fenced off, or should provide only minor protection for a lawn and flower beds; that proposal corresponds with American usage where the front garden is the garden proper, while the back garden often shrinks to a back yard.

Unprotected front gardens have their drawbacks. If not fenced

off they are technically part of the street and should be treated as such with regard to maintenance. Open front gardens might thus have a status similar with the grass verges of the street pattern proper. The whole layout of street and front gardens could then be approached as a problem of unified design. This would not only relieve the householder of an undersirable burden; it would also contribute to improve the appearance of the streets and to achieve the co-ordination of streets, buildings and planting.

The rear gardens might then be developed to suit the individual requirements of each family. Here the problem is to secure privacy and to provide protection from sight, which would allow for more varied use of the garden than hitherto. This can only partly be achieved by garden walls, hedges, fences, shrubs and creepers; to obtain better results the assistance of the house planner must be enlisted and the house shaped in such a way as to offer sheltered corners. Here the family could sit in the open and friends could be received without the neighbours being encouraged to satisfy their curiosity by an unsuitable layout.

The author has suggested<sup>14</sup> houses might be planned in the shape of the letter "L," which would adjoin each other in such a fashion as to provide small enclosed gardens between them. These small gardens of an intensely intimate character would open to the back gardens proper. They might be used for purposes which Mr. John Galsworthy has described in an account of an old London House: "It owned . . . at the back (a great feature) a little court tiled with jade green tiles and surrounded by pink hydrangeas in peacock blue tubs. Here . . . inhabitants or visitors could be screened from the eyes of the curious while they drank tea!" Houses of the kind here contemplated for building could be erected in densities of 10 to 16 to the acre with frontages of between 30 and 35 feet.

The width of the rear gardens in relation to fences or garden walls must be carefully considered by the land sub-divider and, as in the case of the house itself, the wide-front plot gives the better results. From the individual owner's point of view there is also to be considered the extent of the enclosures and their requirements in fences or walls. That will be less if the plot is wider and shorter. A plot of 30 by 120 feet has a circumference of 300 feet, while

<sup>14</sup> *Paipo House*, Walter Segal. *Architect and Building News*, February 19 (1943).

a plot of the same acreage but measuring 20 by 180 feet would have a circumference of 400 feet, one-third more than the first plot.

In addition to individual rear gardens the housing area might have common greens arranged in such a way that the rear gardens of two opposite rows would front on to it. Alternatively, three rows might be planned around a common green in the form of a square with small individual gardens in front of it. This arrangement which is an indigenous pattern, the old "common," makes a delightful layout for greatly increased use. It exists in some south-western and north-western areas of London and has been entirely satisfactory. Care must be taken that the individual gardens are not dwarfed unduly; in point of fact they should not be less than 40 feet deep. In turn the central common green must be at least 60 feet wide to allow for varied use.

With regard to flats the common garden is the usual solution. The main difficulty is the protection, from sight and the noise, of tenants on the ground and first floors. This can be accomplished by the introduction of privacy zones, strips of land immediately adjoining the buildings in a width of not less than 40 feet. Such an area might be suitably planted and zoned off the common grounds by flower beds or similar means. It would thus act as a buffer between the privacy which the buildings should afford and the community character of the open space.

Allotments are popular with many flat dwellers and if well planned and sited they need not present the repulsive and familiar spectacle of ill-built shacks and sheds, surrounded by cabbages that have run to seed. They should be in close vicinity with the dwellings and adequate reservation must be made accordingly. Sizes of allotments vary with different requirements and it is always a good plan to incorporate several types of allotments in one scheme. Large and small plots can thus be made available for tenants, a choice that is welcome to those who cannot afford much time and yet would like to grow some vegetables and flowers.

Allotments should be so sited that they do not interfere with the open spaces about blocks of flats set apart for communal gardens. They should, for instance, not occupy the centre of the open space between two rows of flats; and it would be a poor plan to arrange them in the centre of a square. They should go to the borders of sites where they can be laid out in an unobtrusive manner.

## 3. TRAFFIC AND OPEN SPACES

The relations between traffic and open spaces calls for further remark. Generally, from a zoning point of view, there are three kinds of open spaces: (a) in residential areas, (b) those in business and industrial areas, and (c) in buffer zones. The first should have as little direct contact with traffic as possible, though, in the case of large open spaces, it is essential that good traffic connections are in the vicinity. Green belts and wedges in large cities must have the convenience of high-speed transport to assist those who live at a distance. Major radial roads may run parallel with green wedges, and ring roads of the same order may similarly be related to green belts—always provided that contacts occur only at certain specified points to ensure the safety of pedestrians, and at the same time offer them the facilities of mechanised transport.

Neither radial nor ring roads should pass through open spaces except where crossings occur. These should be negotiated by the separation of levels and here the overhead road for motor traffic would come into its right. Subterranean passages are unpopular with pedestrians and are especially undesirable in parklands.

Small open spaces should, of course, be kept as free from traffic as possible; they are for the use of local residents and should be within walking distance from their dwellings. In the central residential areas of large towns quietness is particularly desirable and where residential precincts are created they should have interior parks. In the redevelopment of existing towns where residential precincts are treated as units the provision of interior common greens need not be uneconomical.

Open spaces in industrial and business areas (b) serve other purposes besides recreation during breaks of working hours. They are useful to maintain spaciousness in development and to divert the flow of traffic from centres of possible congestion; they help in no small degree to brighten the drabness of the working town. Large shopping centres might be planned in the form of squares with buildings enclosing pleasant gardens and blocks of offices might be designed to continue the tradition of the Inns of London, as suggested by Mr. Alker Tripp.

At present many small open spaces in the business districts of large towns are used for parking cars. This is a most undesirable arrangement. Long rows of cars parked in the streets around the open green, the accesses to which they mar, are not only unsightly;

they reduce the value of the green space for any other purpose. While the need for separate parking places is overdue and must be answered they should have no contact with the few green areas of the business town.

Where these green spaces have to give passage to great numbers of pedestrians the ordinary lawn-cum-paths layout is not practical and should be replaced by paving, with flower beds, and other planting. This treatment is more suitable for a setting of large buildings.

Buffer zones (c) eventually to be crossed only at certain specified points by motorised transport and by pedestrians must provide safe access for the latter. Industrial sites must be well served by goods and passenger transport; trains and buses should bring the daily stream of industrial workers as close as possible to the buffer zones whence individual sites might be reached on foot.

As already suggested these open areas should be laid out for recreational purposes. Works canteens might be sited near them *and also shops, which would enable workers to make their purchases more conveniently during breaks of the working day and thus avoid having to rush home before closing time.*

## CHAPTER V

### RESIDENTIAL UNITS

#### 1. MEDIUM SIZE TOWN AS UNIT

ONE of the primary tasks of zoning is to ensure satisfactory relations between dwellings and places of work. Both should be planned in different areas and separated by buffer zones. Both should be so related as to ensure the shortest possible distances from one to the other. Ideally there should be work for each town dweller within 15 to 20 minutes' journey from his residence.

In small towns distances are short and there is a limited variety of occupation. Wherever a citizen may live in the town he will not have a long journey to his place of work. In big towns distances are greater and there is enormous variety of occupation. A man may find work in his trade or vocation in the immediate neighbourhood, or he may have to put up with extensive journeys to fill a job in his line in a remote district.

The small town offers occupation in a limited number of trades within a comparatively short distance of their dwellings. In the large town only a few of any number of the citizens in a residential district find work in the neighbourhood of their dwellings; most of them travel for work to other areas. 10,000 persons living in a small town require much less variety of work than 10,000 inhabitants of a large town. In the former case 10,000 persons make an independent community; in the latter, a far greater number is necessary.

In the medium size town sufficient variety of occupation is available and, with mechanised transport, distances between dwellings and places of work can be kept within desirable limits. The large town offers hardly more variety of occupation to its citizen, though on a larger scale. To make a distinction between the large and the medium size town the following figures are suggested: A medium size town is a town with a population of from 400,000 to 1,000,000; a large town is a town with more than 1,000,000 inhabitants. Such definitions, obviously, are relative, and must be amended in accordance with the increase or decrease of urban populations and

with the sizes of urban settlements. It has been estimated that a town with 100,000 inhabitants at the beginning of this century was a town with a population of only 30,000 in 1800. With increase of the population of urban settlements distinctions must be revised.

To ensure satisfactory relations between dwellings and places of work in large towns suitable subdivisions must be made in the process of zoning. Is the large town to be split up into a great number of small units each with its own industrial area, as once suggested in a plan for the reconstruction of Moscow? Or should there be a limited number of larger units offering within their orbits, residence and a sufficiently varied occupation within tolerable distance?

Suggestion has been made that the medium size town should be the basic unit of the large town, and that zoning regulations in large cities should be framed to allow a subdivision of the urban area into a number of medium size sub-towns, each of which would offer adequate facilities of work, and residence to its inhabitants. These sub-towns should be related to one or several common centres which might have the functions of representation, entertainment and certain types of business respectively. Thus the characteristic features of metropolitan life would be preserved and the great centres of existing towns would continue to function.

In the sub-towns, however, vigorous re-development would be necessary. The existing island structure need not be abolished, but larger islands and the better separation of islands of varying structure must be achieved to suit the different requirements of industry, business and residence. In each sub-town there should be an adequate measure of industry and business to ensure varied occupation for its inhabitants, while the general distribution of industry and business among the various sub-towns should be such that none would attract workers from its neighbours. That aim could not be accomplished in large towns by a subdivision into small residential and industrial units; but on the envisaged scale of the medium size town there would be less difficulty in the way of a satisfactory solution.

## 2. RESIDENTIAL SUB-UNITS

Attempts have been made in recent years to develop suitable methods of subdividing residential areas into smaller units, and recommendations as to sizes and types of residential sub-units have



been put forward. Research on this subject is comparatively new and still in its infancy. The whole problem arises out of the necessity of establishing satisfactory and desirable relations between the various elements in the layout of residential areas, dwellings, communal buildings, open areas, and so forth. Schools, community centres, places of amusement, parks and recreation grounds must all be related to a given number of inhabitants and their dwellings. Also, it is held, problems of environment and local individuality deserve consideration, besides eminently utilitarian factors such as convenience and economy.

The task is to determine the sizes of smaller units which could be composed to form different types of larger units; these in turn might be used to make up the residential areas of towns. There are various means of approach to this aim. It seems essential to relate such basic social units to the size and type of the urban community in which they would be elements. Thus small towns would be made up of different basic residential units as would large towns; in big cities the basic residential unit might indeed be comparable to a small town.

In structure these residential units would consist of a given number of dwellings related to a number of communal buildings; so that each unit would have a community centre with specially defined functions. The nature and extent of their functions might be a means to determine the size of residential units. Among the buildings which a community centre might comprise are places of worship, offices for administration, clinics, library and cinemas, local shopping centres, clubs and other communal buildings. Furthermore, a school system is to be considered, so placed with regard to dwellings as to provide for safety and short walking distances from home to school.

The community centre and the school system which thus would determine the size of the residential units will vary in accordance with local requirements. The school system might comprise only one or several schools, and there might be large or small centres. It is desirable to provide for short distances between dwellings, schools and community centres but, obviously, except in the case of schools, these need not only be walking distances, especially in larger towns. With regard to the latter it is a fact that small schools can be brought nearer dwellings. Large schools, however, offer better facilities for teaching, smaller classes, varied

staff; they can also afford far better equipment than small schools. The larger school offers better and more varied educational facilities but longer distances between home and school will have to be accepted. It might be contended that, especially in the case of secondary schools, the educational advantages of large schools outweigh the disadvantages of longer distances of approach. Nevertheless maximum distances must be fixed and no child should have to walk for more than fifteen minutes to his school.

Similar considerations must be applied to the community centre. Larger centres are more efficient. Local shopping centres might offer a better choice and residents would not have to travel so frequently to the shopping centres of the inner town. Multiple stores in local areas have their great advantages but they also depend on larger numbers of customers. To continue the list there are optimum figures for the efficiency of other establishments such as clinics; and also larger cinemas are known for more varied service than small picture houses.

It seems that with regard to the size of residential sub-units a certain concentration may have its advantages and though, perhaps, in larger units there is less neighbourly feeling than in smaller units, they are, on the other hand, free from a parochialism which threatens the former. The right balance is the obvious aim; and for that purpose residential units should be varied in size, individuality and in character.

A type of sub-unit which is nowadays frequently advocated is the so-called "neighbourhood" which in size and structure is based on several considerations but primarily on the school system. The size of the unit is related to a desirable scholar capacity for two or four elementary schools, with a maximum of about 400 pupils per school. The corresponding figures for the population of the area would be about 5,000 and 10,000 persons respectively. Two neighbourhoods of 10,000, or four neighbourhoods of 5,000, would share one secondary school with separate accommodation for boys and girls.

Such neighbourhoods should be bounded by arterial roads which would make them precincts; their interior development would be on the lines set out in previous pages. Several neighbourhoods would form a community and several communities a borough. This system might be practicable in large towns where greater differentiation is necessary; in smaller towns a simpler structure is preferable. The method of relating the sizes of residential, basic

units to the school system has, in spite of undeniable advantages, a certain danger of rigidity, the more so as the calculations are based on a scholar capacity which, considered desirable at present, may be superseded in future. This fact has been considered by the authors of the County of London Plan who availed themselves of the neighbourhood conception without advocating a standard school.

Progress in the developing conception of residential sub-units and practical experience in the years to come will result, it may reasonably be supposed, in variation of types and forms of design which are indispensable to healthy urban life.

## INDEX

	PAGE		PAGE
Adams, Thomas ... ..	62, 71	Development ... ..	68
Allotments ... ..	83	Layout of ... ..	39, 40, 41
Building lines ... ..	47, 63, 72	Picincts Planning ... ..	43, 68
Garnier, Tony ... ..	30	Radial ... ..	43, 84
Houses, and Housing ... ..	74	Ring ... ..	41, 84
Cost ... ..	69, 76	Roundabouts ... ..	43, 47
Flats ... ..	57, 76, 83	Uses of ... ..	39
Frontage of Plots ... ..	69, 71, 74	Rome ... ..	14
Houses ... ..	57	Smoke ... ..	18
Location of ... ..	19, 58, 61	Streets (see Roads)	
Row Patterns ... ..	66	Towns: Areas: Business ... ..	8, 27
Industry:		Commercial ... ..	14
Concentration of ... ..	12	Residential ... ..	9, 79
Decentralization ... ..	16, 21, 27, 49	Islands ... ..	13, 17, 24, 45
London ... ..	56, 57, 75, 90	New ... ..	22, 31
Modern Architectural Research		Redevelopment of ... ..	31, 74
Group ... ..	37	Shopping Centres ... ..	54
Neutra, R. ... ..	45	Size of ... ..	11, 86
Open Spaces ... ..	29, 30	Structure of ... ..	8, 33
Gardens ... ..	66, 81	Varieties of Lay-out ... ..	39, 41, 61
Green Belt ... ..	26, 31, 78	Traffic: Arteries of ... ..	28, 33, 41
Parkland ... ..	43, 77, 80	Inter-urban ... ..	11, 14, 26
Playgrounds ... ..	77	Market Centre Network ... ..	35
Office Buildings ... ..	54	Mechanised ... ..	36, 42
Population ... ..	8, 77	Parking ... ..	54, 59
Density ... ..	14, 55, 58	Rail ... ..	37, 51
Migration of ... ..	15	Tramways ... ..	52
Radburn, New Jersey ... ..	43	Uneconomical ... ..	49
Ribbon Development ... ..	37, 72	Tripp, Alker ... ..	43, 63, 85
Roads: Access ... ..	53, 64, 72	Tudor Walters Report ... ..	58, 66
Classification of ... ..	46	Wren, Sir C. ... ..	40
Cul-de-sac ... ..	65	Zoning ... ..	29
		Buffer ... ..	26, 85
		Definition of ... ..	84

## **6d. net    DESIGN FOR BRITAIN BOOKLETS    net 6d.**

*Editor:* EDWIN C. FAIRCHILD, Ph.D., M.A., F.S.S., F.R.Hist.S.

Published (for the Co-operative Permanent Building Society) by  
J. M. Dent and Sons, Ltd., London and Letchworth, Herts.

---

The First Series comprised the following:—

1. *Signposts of Building Society Finance.* ARTHUR WEBB, J.P.
  2. *An Old Countryside for New People.*  
C. E. M. JOAD, M.A., D.Litt.
  3. *"Wise for Thy Houses."*  
ALBERT MANSBRIDGE, C.H., Hon.M.A., Hon.LL.D.
  4. *Challenge to Youth.*  
GRAHAM SETON (Lt.-Col. G. S. Hutchison, D.S.O., M.C.).
  6. *National Planning and Redevelopment.*  
Lt.-Col. H. P. CART DE LAFONTAINE,  
O.B.E., F.R.I.B.A., A.M.T.P.I.
  7. *Industrial Background of Housing.* J. HARRY JONES, M.A.
  8. *Rating and Taxation in the Housing Scene.*  
F. C. R. DOUGLAS, L.C.C., M.P.
  9. *The People's Food.* S. HENNING BELFRAGE, M.D.
  10. *An Artist Looks<sup>1</sup> at Britain.*  
BERNARD ADAMS, R.P., R.O.I., F.R.S.A.
  11. *Cottages and Countrymen.* F. STREETON STEED, F.S.I.
  12. *Post-War Homes.*  
H. V. LANCHESTER, Litt.D., F.R.I.B.A., M.T.P.I.
  13. *Design for Labour.* R. COPPOCK, C.B.E., and H. HEUMANN.
  14. *Plan for the New Architecture.*  
W. R. DAVIDGE, F.R.I.B.A., F.S.I., A.M.I.C.E., M.T.P.I.
  15. *Castles in the Street.* ETHEL MANNIN.
  16. *House Ownership and Tenure.* B. E. JAMES, F.S.I.
  17. *Housing in a Well-Planned Britain.*  
EDWIN C. FAIRCHILD, Ph.D., M.A.
- 

*Here Comes Tomorrow* (Special volume, 1s. 3d.).

JOHN MANSBRIDGE.

---

18. *Home.* II. J. MASSINGHAM.
19. *Building Societies; Past, Present and Future.*  
J. B. LEAVER.
20. *Scotland's Housing and Planning Problems.*  
SIR WILLIAM WHYTE, O.B.E., F.R.S.E.
21. *Co-operative Home Building.* W. P. WATKINS, B.A.
22. *Plastics in the Home.*  
V. E. YARSLEY, D.S.C., and E. G. COUZENS, B.Sc.
23. *Our Housing Objective.* REV. C. JENKINSON, M.A.
24. *New Towns for Old.* PROFESSOR S. D. ADSHEAD, M.A.
25. *The Small House.* MISS MARION FITZGERALD.
26. *Housing and Health.* SIR JOHN ORR, D.S.O., M.C., F.R.S.
27. *Post-War Building.* A. C. BOSSOM, F.R.I.B.A., M.P.
28. *Building Societies and the Housing Problem.*  
PROFESSOR G. D. H. COLE, M.A.
29. *Planning and Performance.*  
PROFESSOR W. A. ROBSON, M.A.
30. *Houses and Towns After the War.*  
MRS. E. G. McALLISTER.
31. *Public Health and Social Conditions.*  
DR. CHARLES PORTER, B.Sc., M.R.C.P.
32. *Farm Cottages and Post-War Farming.* A. G. STREET.
33. *Local Rates and Post-War Housing.*  
SHERA D. SIMON (Lady Simon).
35. *Housing Societies.* REGINALD BROWNE, F.I.A.A., F.A.A.S.
36. *A Hundred New Towns?*  
A. TRESTAN EDWARDS, M.A., F.R.I.B.A., A.M.T.P.I.
37. *Twelve in Search of a House.*  
A SYMPOSIUM by a charlady, doctor, agricultural labourer,  
clergyman, woman paying Income Tax, a miner, and others.

